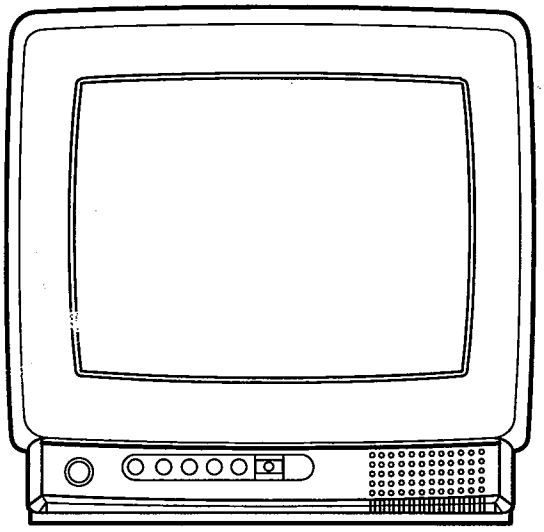
1964 3212

ORDER NO. MTC9503605A1
PQ1

Service Manual

Color Television



Panasonic Models	Chassis
CT–9R10T	**ADP243**
CT–9R10CT	**ANDP243**
CT–9R20T	**AMDP243**

Quasar Model	Chassis
TP917T	**ALDC243**

Main Manual
(NA4)

Specifications

Power Source:	120 volts, 60 Hz, AC
Power Consumption:	0.75 amps Max
AC/DC Power Source:	120 volts, 60 Hz, AC
Model CT–9R20T	12V DC (car battery)
Power Consumption:	AC 0.75 amp Max.
Model CT–9R20T	DC 6.0 amps Max.
Antenna Terminal Impedance:	(1) UHF/VHF 75Ω input
Channel Capability:	181 Channels (Phase 20 Synthesizer)
Off the Air:	VHF 2~13, UHF 14~69
Cable:	125 Channels
Sound Output:	1.5W (10% distortion)

Remote Control:	Infra–red System **Panasonic Easicon** EUR501332 (CT–9R10T, CT) EUR501333 (CT–9R20T) **Quasar Easy Icon** EUR501342 (TP917T)
Picture Tube:	9" diagonal (Viewing area) 90 degree deflection A23KQU22X
Anode Voltage:	19.0kV Max. (Zero beam) 18.0kV ± 1.0kV
Dimensions & Weight:	
Height:	11 – 1/32" (280mm)
Width:	11 – 27/32" (301mm)
Depth:	10 – 41/64" (270mm)
Weight:	14 lbs (6.4Kg)

Specifications are subject to change without notice or obligation.
Dimensions and weight are approximate measurements.

The service technician is required to read and follow the "Safety Precautions" and "Important Safety Notice" in this manual.

"WARNING! This Service Manual is designed for experienced repair technicians only and is not designed for use by the general public. It does not contain warnings or cautions to advise non–technical individuals of potential dangers in attempting to service a product. **Products powered by electricity should be serviced or repaired only by experienced professional technicians.** Any attempt to service or repair the product or products dealt with in this Service Manual by anyone else could result in serious injury or death."

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Important Safety Notice

There are special components used in this television set which are important for safety. These parts are identified on the schematic diagram by the symbol ⚠ and printed in **BOLD TYPE** on the replacement parts list. It is essential that these critical parts should be replaced with manufacturer's specified parts to prevent X–RADIATION, shock, fire or other hazards. Do not modify the original design without the permission of manufacturer.

Safety Precautions

General Guidelines

An ISOLATION TRANSFORMER should always be used during the servicing of a receiver whose chassis is not isolated from the AC power line. Use a transformer of adequate power rating as this protects the technician from accidents resulting in personal injury from electrical shocks. It will also protect the receiver and its components from being damaged by accidental shorts of the circuitry that may be inadvertently introduced during the service operation.

When servicing observe the original lead dress, especially in the high voltage circuit. In case of a short circuit, replace every part which has overheated.

Always REPLACE PROTECTIVE DEVICES, such as fishpaper, isolation resistors and capacitors and shields after working on the receiver. Use only manufacturers recommended rating for fuses, circuit breakers, etc.

High potentials are present when this set is operating. Operation of the set without the rear cover involves the danger of electric shock from the set's power supply. Servicing should not be attempted by anyone who is not thoroughly familiar with the precautions necessary when working on high–voltage equipment.

Extreme care should be used in HANDLING THE PICTURE TUBE. Rough handling may cause it to implode due to atmospheric pressure (14.7 lbs per sq. in.). Do not nick or scratch the glass or subject it to any undue pressure in removal or installation. When handling, use safety goggles and heavy gloves for protection. Discharge picture tube by shorting the anode connection to chassis ground (not cabinet or other mounting parts). When discharging, go from cold ground (i.e. dag ground lead) to anode with a well insulated piece of wire.

Avoid prolonged exposure at close range to unshielded areas of the picture tube. Possible danger of personal injury from unnecessary exposure to X–ray radiation may result.

The TEST PICTURE TUBE used for servicing the chassis at the bench should incorporate a safety glass and magnetic shield. The safety glass affords shielding from the tube viewing area against X–ray radiation as well as implosion protection. The magnetic shield limits X–ray radiation around the bell of the picture tube in addition to restricting magnetic effects. When using a picture tube test jig for service, ensure that jig is capable of handling 31kV without causing X–radiation.

BEFORE RETURNING A SERVICED RECEIVER **(of any type)** TO THE OWNER, the service technician must thoroughly test the unit to be certain that it is completely safe to operate without danger of electrical shock. DO NOT USE A LINE ISOLATION TRANSFORMER WHEN MAKING THIS TEST.

Leakage Current Cold Check

Unplug the AC cord and connect a jumper between the two plug prongs.

Measure the resistance between the jumpered AC plug and each exposed metallic part such as screwheads, antenna terminals, control shafts, etc. If the exposed metallic part has a return path to the chassis, the reading should be between 240kΩ and 5.2MΩ. When the exposed metal does not have a return path to the chassis, the reading must be infinite.

Leakage Current Hot Check (See Figure)

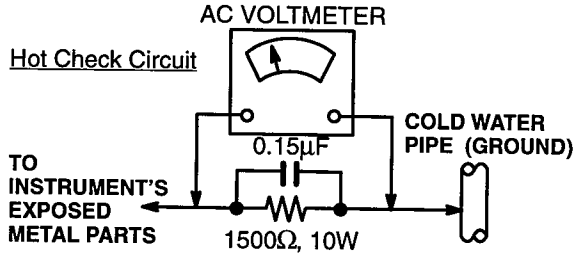
Plug the AC cord directly into the AC outlet. Do not use an isolation transformer during the check.

Connect a 1.5kΩ 10 watt resistor in parallel with a 0.15μF capacitor between each exposed metallic part and ground. Use an earth ground, for example a water pipe.

Using an AC voltmeter with 1000 ohms/volt or more sensitivity, measure the potential across the resistor.

Move the resistor connection to each exposed metallic part and measure the voltage present.

Check that any potential does not exceed 0.75 volt RMS. A leakage current tester (Simpson Model 229, Sencore Model PR57 or equivalent) may be used in the above hot check, in which case any current measure must not exceed 1/2 milliamp. In case any measurement is out of the limits specified, there is a possibility of a shock hazard and the set must be repaired and rechecked before it is returned to the customer.



X–Radiation

WARNING: The potential source of X–radiation in TV sets is the High Voltage section and the picture tube.

NOTE: It is important to use an accurate, periodically calibrated high voltage meter.

Adjust BRIGHTNESS, PICTURE, SHARPNESS and COLOR controls to Minimum.

Measure the High Voltage. The high voltage meter should indicate 18.0kV(±1.0kV). If the upper meter indication is out of tolerance, immediate service and correction is required to insure safe operation and to prevent the possibility of premature component failure.

Horizontal Osc. Disable Circuit Test

This test must be made as a final check before the set is returned to the customer. See HORIZONTAL OSC. DISABLE CIRCUIT PROCEDURE CHECK in this manual.

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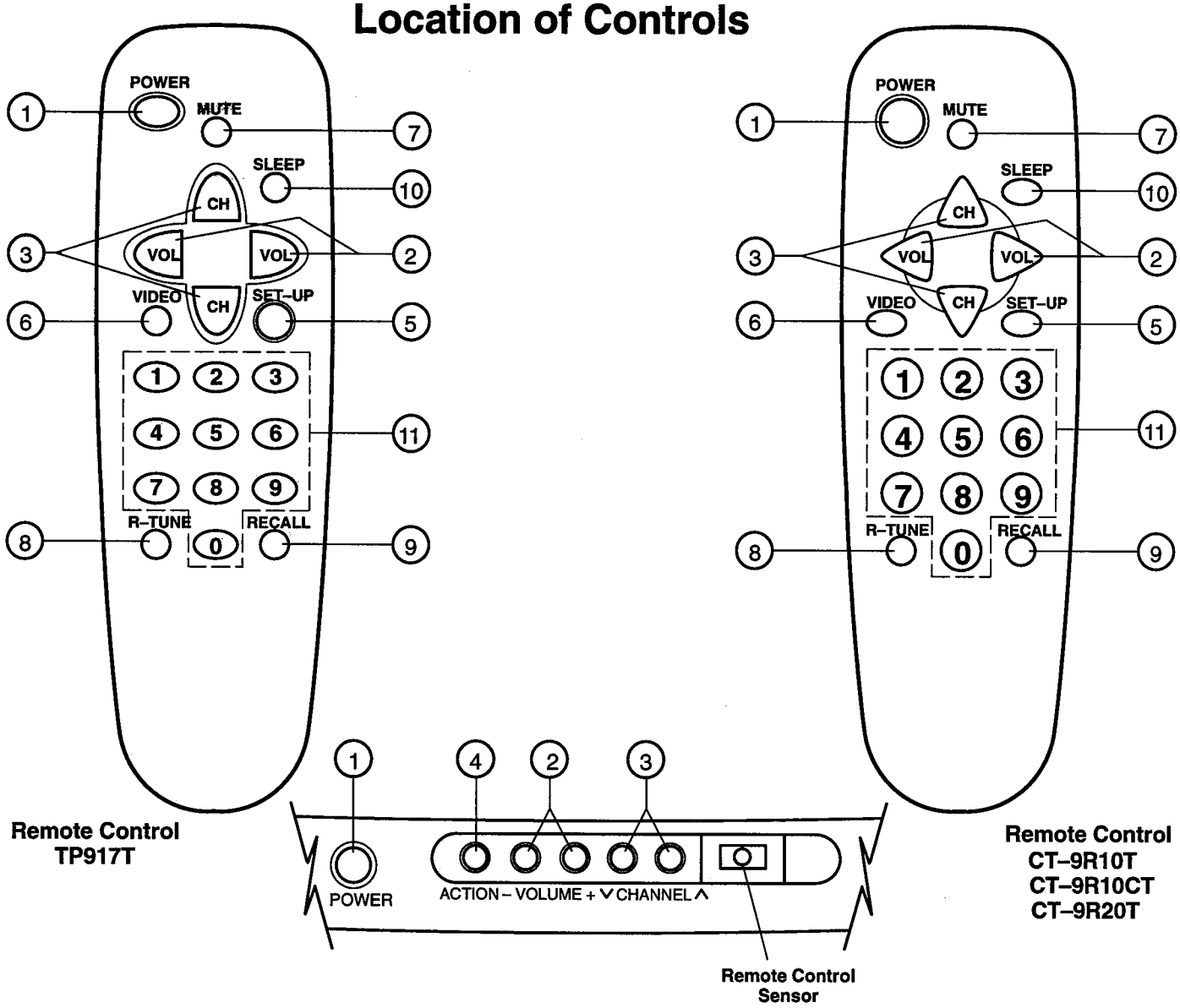
Followed by 4 Large Schematic Sheets With All Other Schematics, Notes, Voltage Charts & Waveforms.

Location of Controls



Remote Control
TP917T

Remote Control Sensor

Remote Control
CT-9R10T
CT-9R10CT
CT-9R20T

Quick Reference Control Operation

1. **Power Button** – Press to turn ON or OFF.
2. **Volume Buttons** – Press to adjust Sound Level. Press to adjust or activate Video and Set–Up Menus when displayed.
3. **Channel Buttons** – Press to select programmed channels. Press to select desired features when menus are displayed.
4. **Action Button (On Receiver)** – Press to access both Video and Set–Up Menus.
5. **Set–Up Button** – Press to access Set–Up Menu and then press the CH UP or DOWN button to select Auto Programming, Manual Programming, or Antenna.
6. **Video Button** – Press to access the Picture Adjustment Menu and then press the CH UP or DOWN button to select Color, Tint, Brightness, Picture, Sharpness or Picture Norm.
7. **Mute Button** – Press to mute sound. A second press returns sound to its previous level.
8. **R–Tune (Rapid Tune) Button** – Press to switch between two channels.
9. **Recall Button** – Press to display status of Sleep Timer and Channel number.
10. **Sleep Button** – Press to select automatic Turn OFF in 30, 60 or 90 minutes.
11. **Keyboard "0 through 9" Buttons** – Press desired channel number to access any channel.

Action Button (on Receiver)

The Action button (on Receiver) will allow you to access all Video and Set–Up Menus.

1. Press the ACTION button (on Receiver) to access into the Video and Set–Up Menu.

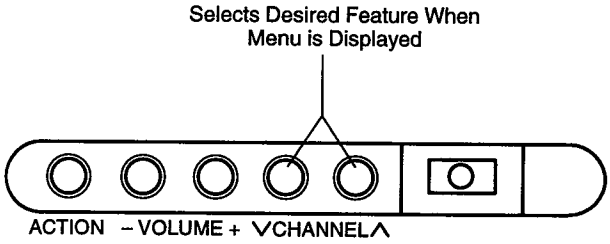
2. Press the CH UP or DOWN button (on Receiver) to select one of the following features.

The Set–Up Menus:

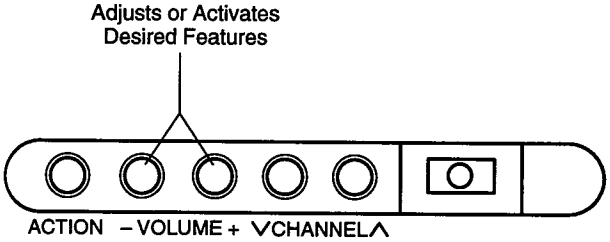
- Auto Program
- Manual Program
- Antenna
- Language (English/Español)
  English only in model CT–9R10CT

The Video Menus:

- Color
- Tint
- Brightness
- Picture
- Sharpness
- Picture Norm



3. Press the VOL LEFT or RIGHT button (on Receiver) to adjust or activate your desired features.



4. Press the Action button (on Receiver) to exit either Set–Up or Video Menus.

AC/DC Operation (CT–9R20CT)

Power Sources

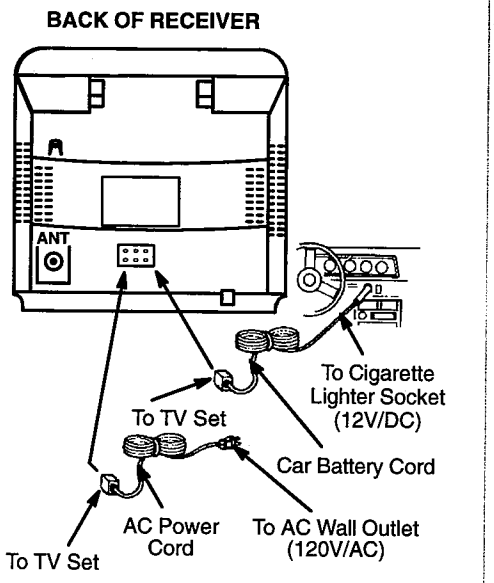
This TV set operates on 120 volt, 60Hz AC and on 12 volt negative ground car battery systems through the cigarette lighter socket. Two power cords (AC Power Cord and Car Battery Cord) are supplied.

A. House Current Operation

Insert the AC power cord (supplied) into the socket on the rear of the TV and connect the plug to a convenient wall outlet (120 Volt, 60Hz).

This plug is polarized for safety. If you are unable to insert the plug fully into the outlet try reversing the plug. If the plug should still fail to fit, contact your electrician. Do not defeat the safety purpose of the polarized plug.

CAUTION: TO PREVENT ELECTRIC SHOCK DO NOT USE THIS (POLARIZED) PLUG WITH A RECEPTACLE OR OTHER OUTLET UNLESS THE BLADES CAN BE FULLY INSERTED TO PREVENT BLADE EXPOSURE.



B. Car Battery Operation

Prior to Use:

Before connecting the car battery cord (supplied), check the polarity of your car battery. The car cord supplied is designed for use with a negative grounded battery. If your car has a positive ground, consult your Panasonic dealer. If you have any questions concerning the car polarity or battery voltage, consult your car dealer.

Connection and Use:

Remove the cigarette lighter from your car and insert the car battery cord plug in its place. Insert the car cord into the socket on the rear of the TV. To turn Receiver ON, press the POWER button.

Notes:

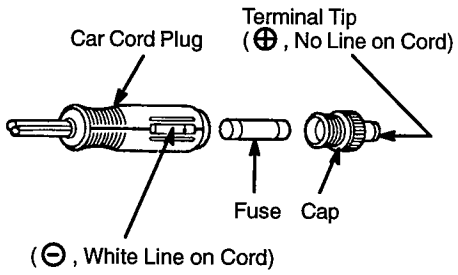
1. While the car is moving, it may be difficult to obtain good reception due to signal variations.
2. It is recommended to operate with the engine idling under the following conditions:
   a) Very low outside temperatures likely to cause difficult engine starts.
   b) Viewing the Receiver for more than just a few hours. (For personal safety when in a vehicle with engine idling always keep a window slightly open to prevent being overcome from possible engine fume leaks).
3. Do not operate the set when starting the engine to avoid overloading the engine.
4. When finished viewing, turn OFF POWER and disconnect power cord from cigarette lighter. Failure to do so may discharge your car battery.

Fuse Replacement

If the car cord does not seem to function normally, check if the fuse in the plug is blown. If the fuse is blown, replace it with the spare fuse supplied.

Proceed as follows:

1. Turn the TV set OFF and unplug the car cord from the cigarette lighter socket.
2. Loosen and remove the cap.
3. Pull out the fuse.
4. Install the spare fuse supplied.
5. Replace the cap.
6. Plug the car cord into the cigarette lighter socket and turn the TV set ON.



Notes:

1. When the fuse is blown, replace it only with the same type, 7A–125V. Never use an ordinary piece of wire.
2. Always keep the cigarette lighter socket of the car clean. If the socket is dirty with cigarette ash, the resulting bad contact may overheat the car cord plug.

Disassembly For Service

Back Cover

Remove all screws indicated by ◄■ on back of cabinet.

1. 2 screws at cabinet top (side of carrier handle).
2. 2 screws underneath cabinet.
3. 1 screw at cabinet lower right side.
4. (CT–9R10T/CT, TP917T)
   2 screws by antenna connection.
   (CT–9R20T)
   1 screw by antenna connection.
5. (CT–9R20T)
   2 screws by AC/DC cord connection.

A–Board – Main Chassis

Lay Receiver on its side for service and component removal.

1. For complete chassis removal, slide Main Board completely out of guide rails.
   (CT–9R20T)
   Remove 2 screws that secures P–Board first.

NOTE: Some tie wraps that secure wire dressings may have to be unfastened.

C–Board – CRT Output

1. Plugs into socket on CRT neck.

P–Board – (CT–9R20T) DC Power Supply and Degauss Circuit

P–Board is fully accessible without removal.

1. If removal is necessary, 2 screws secure the board to the cabinet side.

Disassembly for CRT Replacement

1. Discharge CRT as instructed in Safety Precautions.
2. Disconnect yoke plug, degaussing coil plug (connects to P–Board in some sets), speaker plug (A3), from Main board and CRT 2nd anode button. Remove DC Power Supply (P–Board, when applicable).
3. Remove C–Board from CRT neck and unplug black wire (CRT dag ground) from board.
4. Slide main chassis assembly completely out with CRT Board and DC Power Supply (P–Board) when applicable.

CRT Replacement

1. Perform DISASSEMBLY FOR CRT REPLACEMENT procedure.
2. Insure CRT H.V. anode button is discharged before handling CRT. See SAFETY PRECAUTIONS on handling the picture tube.
3. Remove components on CRT neck and place cabinet face down on a soft pad.
4. Note original order of CRT mounting hardware as you remove them from CRT mounting brackets at each corner of CRT.
5. Remove CRT with dag ground braid attached.
6. Note original locations and mounting of degaussing coil and dag ground assembly to insure proper reinstallation.

   To remove degaussing coil:

   - Note that degaussing coil is retained in position to the cabinet. (It doesn't need removal.)

   To remove dag ground braid:

   - Unhook coil spring from lower left CRT ear.
   - Release braid loops from upper left and lower right CRT ears.
7. Mount dag ground braid on replacement CRT.
8. Replace components on CRT neck and re–install into cabinet. Make sure all ground wires and circuit board plugs get connected.

Purity and Convergence Procedure

Adjustment should be necessary only if the CRT or deflection yoke is replaced or if someone has disturbed the setting. The complete procedure consists of:

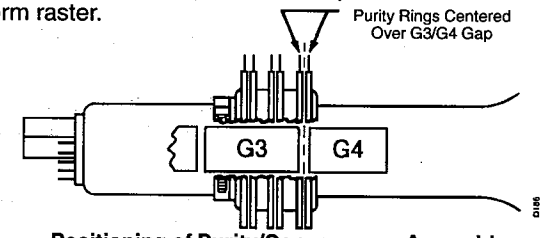
1. Initial static convergence
2. Setting purity
3. Final static convergence

When CRT or Yoke is Replaced

Place the yoke on the CRT neck (do not tighten clamp).

Position purity/convergence assembly as shown and tighten clamp snugly. Cut hot–melt glue seal on assembly and place like tabs of purity device together at 12 o'clock to reduce its magnetic field effect. Manually degauss CRT.

Turn Receiver ON and slide deflection yoke back and forth on neck of CRT. Stop at position that produces a near white, uniform raster.



Positioning of Purity/Convergence Assembly

Initial Center Static Convergence

Connect dot/crosshatch generator to Receiver and tune in signal. Observe misconvergence at center of screen only.

Adjust 4 pole magnet (center rings): separate tabs and rotate device to converge blue with red.

Adjust 6 pole magnet (rear rings): separate tabs and rotate device to converge blue and red (magenta) with green.
NOTE: Precise convergence at this point is not important.

Purity Adjustment

When in the Serviceman Mode for making electronic adjustments, Press the Remote Control (RECALL) button to enter Purity Check. (See Service Adjustments Electronic Controls.)

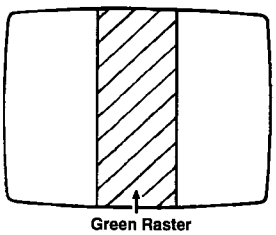
Operate the Receiver for 60 minutes using the first Purity check field (white screen) to stabilize the CRT.

Degauss the Receiver fully by using an external degaussing coil.

Press the Remote Control (RECALL) button again until the Purity Check (green screen) appears.

Loosen the deflection yoke clamp screw and move the deflection yoke back as close to the purity magnet as possible.

Adjust the front rings to set the vertical green raster precisely at the center of the screen. (Shown below.)



Green Raster

Slowly move the deflection yoke forward and adjust for the best overall green screen.

Tighten the deflection yoke clamp screw.

Press the Remote Control (RECALL) button again until the Purity Check (blue screen) and (red screen) appear and observe that good purity is obtained on each respective field.

Press the Remote Control (RECALL) button again until Purity check (white screen) appears. Observe the screen for uniform white. If not, repeat above procedure.

Final Convergence Procedure

NOTE: Before attempting convergence adjustment, vertical size and focus adjustments must be completed. Connect a dot pattern generator to the set. The brightness level should be no higher than necessary to obtain a clear pattern.

Converge the red and blue dots at the center of the screen by rotating the 4 pole (R with B) Static Convergence Magnets.

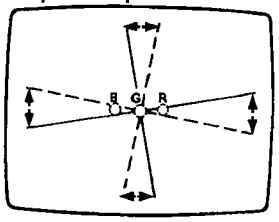
Align the converged red/blue dots with the green dots at the center of the screen by rotating the 6 pole (R/B with G) Static Convergence Magnets. Melt wax with soldering pencil to reseal magnets.

Slightly tilt (do not rotate) the deflection yoke vertically and horizontally to obtain good overall convergence.

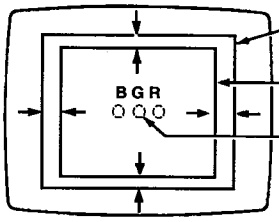
After vertical adjustment of the yoke, insert wedge at 11 o'clock position, then make the horizontal tilt adjustment.

Secure deflection yoke by inserting side two wedges at 3 and 7 o'clock positions.

Apply adhesive between tab (thin portion) of wedge and CRT and place tape over tab to secure to CRT.



As the yoke is moved vertically, the rasters produced by the outside guns rotate in opposite directions.

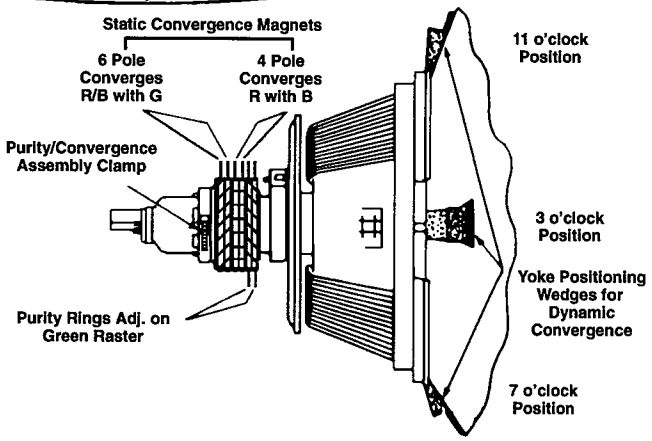


Raster produced from one of the outside electron beams

Raster from the other outside electron beam

Static convergence magnets are set for center convergence

As the yoke is moved horizontally, one raster gets larger while the other gets smaller


Static Convergence Magnets
6 Pole Converges R/B with G
4 Pole Converges R with B
11 o'clock Position
Purity/Convergence Assembly Clamp
3 o'clock Position
Yoke Positioning Wedges for Dynamic Convergence
Purity Rings Adj. on Green Raster
7 o'clock Position

Permalloy Convergence Corrector Strip (Part No. OFMK014ZZ)

This strip is used in some sets to match the yoke and CRT for optimum convergence. If the yoke or CRT is replaced, the strip may not be required.

First converge the set without the strip and observe the corners.

If correction is needed:

1. Place strip between CRT and yoke, in quadrant needing correction. Slowly move it around for desired results.
2. Press adhesive tightly to the CRT and secure with tape.

Service Notes

IMPORTANT: To protect against possible damage to solid state devices due to arcing or static discharge, make certain all ground wires and CRT DAG wire are securely connected.

CAUTION: The power supply circuit is above earth ground and the chassis cannot be polarized. Use an isolation transformer when servicing to avoid damage to test equipment or chassis. Connect test equipment to correct ground (⏚) or (⏚) when servicing or incorrect readings will occur.

WARNING: This Receiver has been designed to meet or exceed applicable safety and X–radiation protection as specified by government agencies and independent testing laboratories.

To maintain original product safety design standards relative to X–radiation and shock and fire hazard, the parts indicated by the symbol ⚠ on the schematic must be replaced with identical replacement parts. Order parts from the manufacturer's parts center using numbers shown in this service manual or give complete chassis number and part reference number.

For optimum performance and reliability, all other parts should be replaced with components having identical specifications.

Horiz Osc Disable Circuit

This chassis employs a special circuit to protect against excessive high voltage and beam current. If for any reason the high voltage and beam current exceed a predetermined amount, this circuit operates and detunes the horizontal oscillator. This limits high voltage.

The over–voltage protection circuit is not adjustable. However, if components indicated by the symbol ⚠ on the schematic in either the horizontal sweep system or the over–voltage protection circuit itself are changed the operation of the circuit should be checked using the following procedure.

Equipment needed to check disable circuit:

1. Accurate voltmeter (0 – 200V scale)
2. High Voltage Meter (0 – 40kV)
3. Variac and Isolation Transformer

Procedure:

1. Tune in a station to verify horizontal is in sync.
2. Obtain Monoscope pattern or signal generator crosshatch pattern.
3. Connect voltmeter (–) to TPD2 and (+) to TPD1. Adjust BRITE to (0) and PICTURE for 0.9 volt reading on voltmeter.
4. Turn Receiver OFF. Connect jumper across R803 (10W) Resistor.
5. Reduce AC supply voltage to approx. 100V. Connect high voltage meter to CRT 2nd anode (H.V. button). **NOTE:** Use Dag Ground for minus (–) lead connection of meter.
6. Turn Receiver ON. Slowly raise AC supply voltage and confirm that high voltage does not exceed 21.0kV, when horizontal just begins to pull out of sync. If high voltage is not within the specified limit, the cause must be determined before the Receiver is returned to the customer.

Power Supply Adjustment Procedure (Model CT–9R20T)

AC Test Preparation

1. Plug AC cord in power supply socket in rear of set.
2. Plug AC cord into 120 V 60Hz source (using isolation transformer).
3. Turn main POWER switch ON.

130.0V B+ Voltage Confirmation

1. Set BRIGHT and PICTURE by using Video Menu to Minimum.
2. Connect a DVM between R803 (IC801 pin 4 side) and Hot ground (⏚).
3. Confirm that B+ voltage is 130.0V ±1.0V. This voltage supplies B+ to Horizontal Output & Flyback circuits.

Source Voltage Chart

Use 120V AC line input. With jumper, short ⊕ C306 to ground (⏚). BRIGHT and PICTURE of Video Menu adjusted to Minimum. Use cold ground (⏚) for minus lead of DVM.

Cathode of D557	+5.0V ±1V
Cathode of D560	+9.0V ±1V
Cathode of D090	+12.0V ±1V
Cathode of D551 (TPD9)	+16.7V ±1V
Cathode of D553	+18.0V ±1V
Cathode of D561 (TPD8)	+23.40V ±2V
Cathode of D554	+139V ±7V

Adjust Video menu for normalized video adjustments.

DC Test Preparation

1. Disconnect AC cord from power supply socket in rear of set and connect DC car cord.
2. Connect 12V DC/7 Amp (Minimum) power supply to DC cord plug adapter as shown.
3. Turn on DC power supply adjust to 12V.
4. Turn Receiver ON.
5. P–Board now ready for Test/Alignment.

12V DC P–Board Source Voltage Chart

D852 (Cathode)	12V
D851 (Cathode)	130V

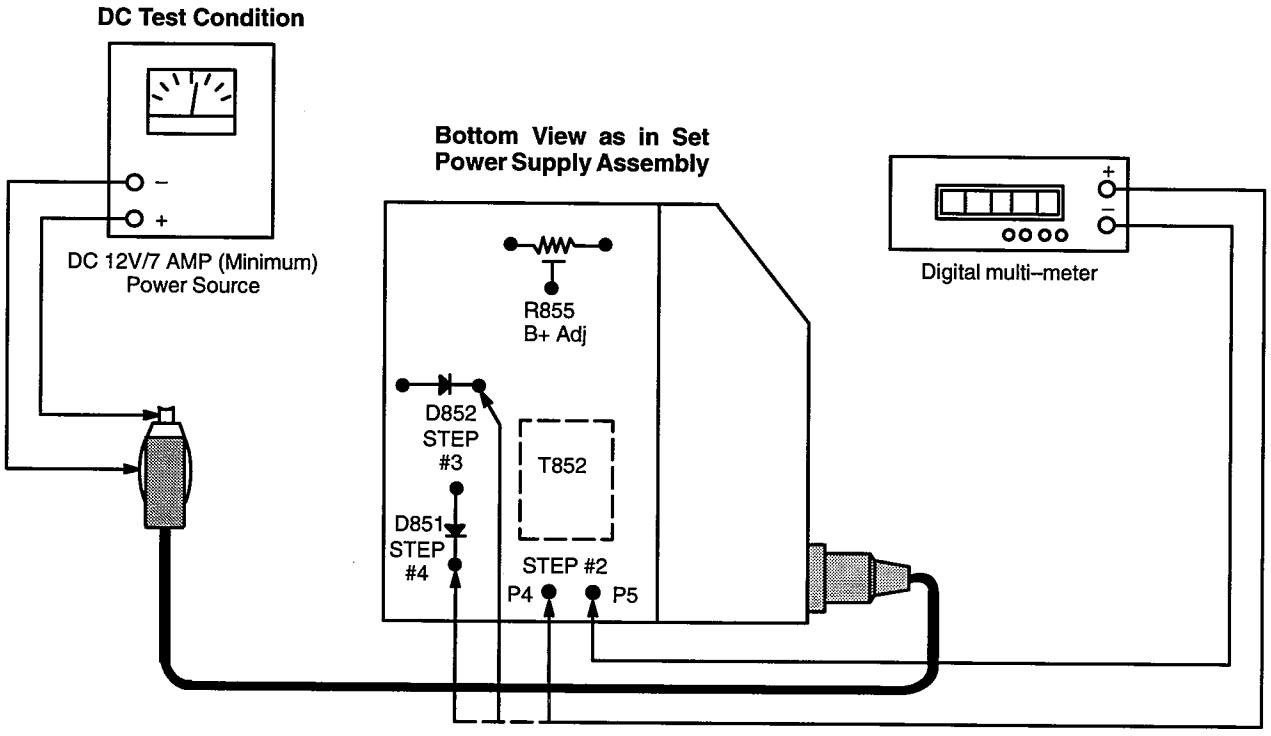
130.0V Alignment (P–Board)

Preparation

1. Operate the Receiver for 20 minutes.
2. Connect a digital multi–meter (+) to P4 and (–) to P5. Confirm +12V DC.
3. Connect a digital meter (+) to D852 (Cathode) and confirm 11.65V ±0.1V.
4. Connect the digital multi–meter (+) to D851 (Cathode).

Alignment Procedure

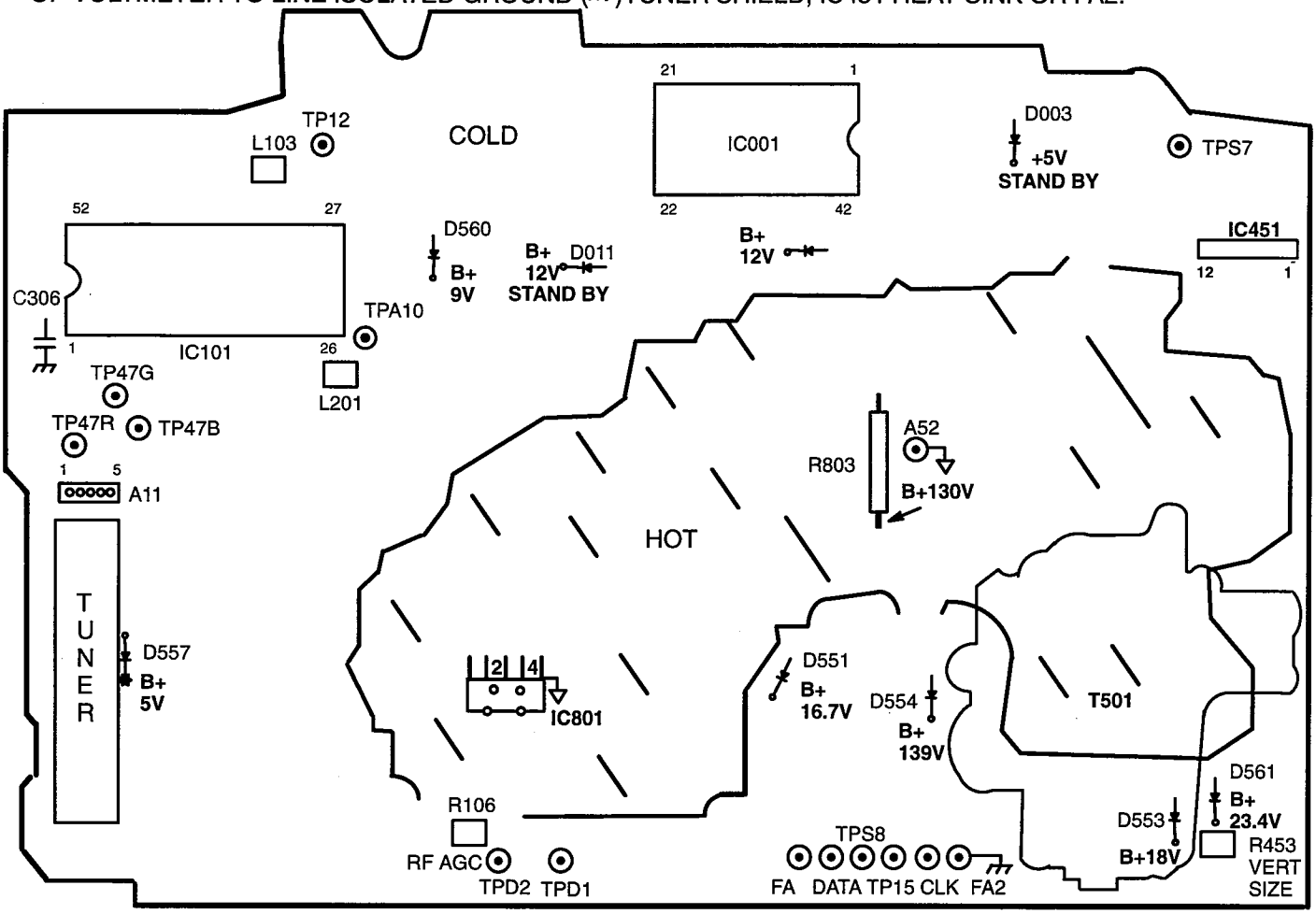
1. Tune in a black and white signal under normal reception conditions.
2. Set BRIGHT and PICTURE controls of Video menu to Minimum (0).
3. Adjust R855 (B+ adj.) to set the output voltage to 130.0V ±1.0V at Cathode D851 (P6).
4. Vary 12V power supply from 10V to 16V. Confirm that B+ remains less than 133 volts DC and current is less than 6 amps at 12V DC power.
5. Return Video menu to Normal.



Service Adjustment Procedures

ALL SERVICE ADJUSTMENTS ARE FACTORY PRESET AND SHOULD NOT REQUIRE ADJUSTMENT UNLESS CONTROL AND/OR ASSOCIATED COMPONENTS ARE REPLACED.

NOTE: CONNECT MINUS LEAD OF VOLTMETER TO CORRECT GROUND FOR CIRCUIT BEING CHECKED. WHEN NECESSARY TO USE A LINE OPERATED GROUND, THE GROUND INDICATION (⏚) WILL BE INDICATED. FOR THIS GROUND, USE IC801 HEAT SINK. FOR ALL OTHER CIRCUITS, CONNECT MINUS LEAD OF VOLTMETER TO LINE ISOLATED GROUND (⏚)TUNER SHIELD, IC451 HEAT SINK OR FA2.



130.0V B+ Voltage Confirmation

1. Set BRIGHT and PICTURE by using Video Menu to Minimum.
2. Connect a DVM between R802 (IC801 pin 4 side) and Hot ground (⏚).
3. Confirm that B+ voltage is 130.0V ±1.0V. This voltage supplies B+ to Horizontal Output & Flyback circuits.

Source Voltage Chart

120V AC line input. BRIGHT and PICTURE of Video Menu adjusted to Minimum. Use cold ground (⏚) for minus lead of DVM.

Cathode of D090	+12.0V ±1V
Cathode of D551 (TPD9)	+16.7V ±1V
Cathode of D553	+18.0V ±1V
Cathode of D561 (TPD8)	+23.4V ±2V
Cathode of D554	+139.0V ±7V

Adjust Video menu for normalized video adjustments.

B+ 5V Source Voltages

Volatile 5V:

Cathode D557 = Tuner BP, IC101 (B+ V_{cc}), RF AGC (R106).

Standby 5V:

Cathode D003 = Keyboard, IC001 (V_{DD}), I^2C EEPROM (IC002), IC003, Remote Receiver.

B+ 9V Source Voltage

Cathode D560 = Tuner, IC101 (B+ V_{cc}), (HOLD DOWN) (AFC OUT), Q306 (Video).

B+ 12V (Stand–by)

Cathode D011 = RL001 (on–off relay), Q0023 (Relay Switch), IC101 (Horiz. Vcc).

High Voltage Check

1. Select an active TV channel and confirm that horizontal is in sync.
2. Adjust Brightness and Picture using Video menu so video just disappears
3. Confirm B+ 130V is within limit.
4. Using a calibrated high voltage meter confirm that High Voltage is 18.0kV ±1.0kV.

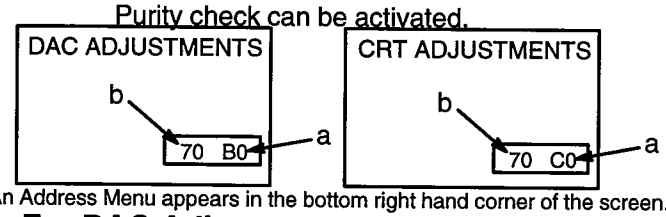
Serviceman Mode (Electronic Controls)

This chassis has new electronic technology using the I^2C Bus Concept.The system usually performs as a control function and replaces many of the required mechanical controls. Instead of adjusting various mechanical controls individually, many of the control functions are now performed electronically by using "On Screen Menu". (The Serviceman Adjustment Mode.)

NOTE: It is suggested that a serviceman read all the way through and understand the following procedure for Entering/Exiting the Serviceman Adjustment Mode; then proceed to follow the instructions working with the Receiver. After a person is familiar with this adjustment procedure, use the Instructional Flow Chart for Serviceman Mode as a quick guide.

Entering Serviceman Mode:

1. While the Receiver is ON and operating in Normal Mode, momentarily short test point FA to cold ground (⏚) FA2.
   "The Receiver enters the Aging Mode".
   (The yellow letters "CHK" appears in the upper left CRT area.)
   (The VOLUME UP/DOWN will adjust rapidly.)
2. **Press** ACTION button and VOLUME UP button on Receiver Control Panel simultaneously.
   "The Receiver enters the Servicemans Mode".
   (The "CHK" turns to the color red.)
   (The VOLUME UP/DOWN will adjust normally.)
   (All customer controls are set to a nominal level.)
3. **Press** the POWER button on the Remote Control to select one of three Serviceman Adjustment Modes.
   - B = Serviceman DAC ADJUSTMENTS
   - C = Serviceman CRT ADJUSTMENTS
   - "CHK" = Normal operation of channel UP/DOWN and volume UP/DOWN. Purity check can be activated.



An Address Menu appears in the bottom right hand corner of the screen.

For DAC Adjustments:

a.) Press CHANNEL UP/DOWN or DIAMOND UP/DOWN on the Remote Control to select any of 6 Service Adjustment Addresses.

Important Note: Write down the original value (b in detail) for each address adjustment before adjusting anything. It is easy to adjust the wrong item.

b.) Press VOLUME UP/DOWN or DIAMOND RIGHT/LEFT on the Remote Control to adjust the level of the selected Service Adjustment.

BO = Sub Bright
↓
B1 = Sub Color
↓
B2 = Sub Tint
↓
B3 = Sub Picture
↓
B4 = Video Det. Level
↓
B5 = Sound Output

Adjustment Range and Default level values for Service Adj.

Service Adjustment	Adj Range	Default Level
Sub Bright (BO)	0 ~ 127	61
Sub Color (B1)	0 ~ 63	21
Sub Tint (B2)	0 ~ 63	21
Sub Picture (B3)	0 ~ 63	15
Video Detector Level (B4)	0 ~ 15	8
Sound Out (B5)	0 ~ 15	8

Press the POWER button on the Remote Control to select Serviceman CRT Adjustment Mode.

For CRT Adjustments:

a.) Press CHANNEL UP/DOWN or DIAMOND UP/DOWN on the Remote Control to select any of 6 Service Adjustments.

Important Note: Write down the original value (b in detail) for each address adjustment before adjusting anything. It is easy to adjust the wrong item.

b.) Press VOLUME UP/DOWN or DIAMOND RIGHT/LEFT on the Remote Control to adjust the level of the selected Service Adjustment.

CO = Horiz. Center
↓
C1 = RED Cutoff
↓
C2 = GRN Cutoff
↓
C3 = BLU Cutoff
↓
C4 = RED Drive
↓
C5 = BLU Drive

Adjustment Range and Default level values for Service Adj.

CRT Adjustment	Adj Range	Default Level
Horiz Centering (C0)	0 ~ 15	8
RED Cutoff (C1)	*0 ~ 511	80
GRN Cutoff (C2)	*0 ~ 511	80
BLU Cutoff (C3)	*0 ~ 511	80
RED Drive (C4)	0 ~ 255	80
BLU Drive (C5)	0 ~ 255	80

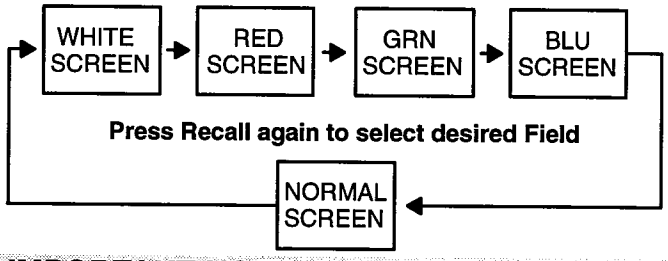
*Adjustment indicated in 2 steps (0 ~ 255) ➡ (1 ~ 255)

Press the POWER button on the Remote Control to select Serviceman "CHK" mode.

To Check Purity:

Press the RECALL button on the Remote Control to enter Purity Field Check Mode.

NOTE: Must be in Serviceman Mode to get color.



IMPORTANT NOTE: Always Exit Serviceman Mode After Use.

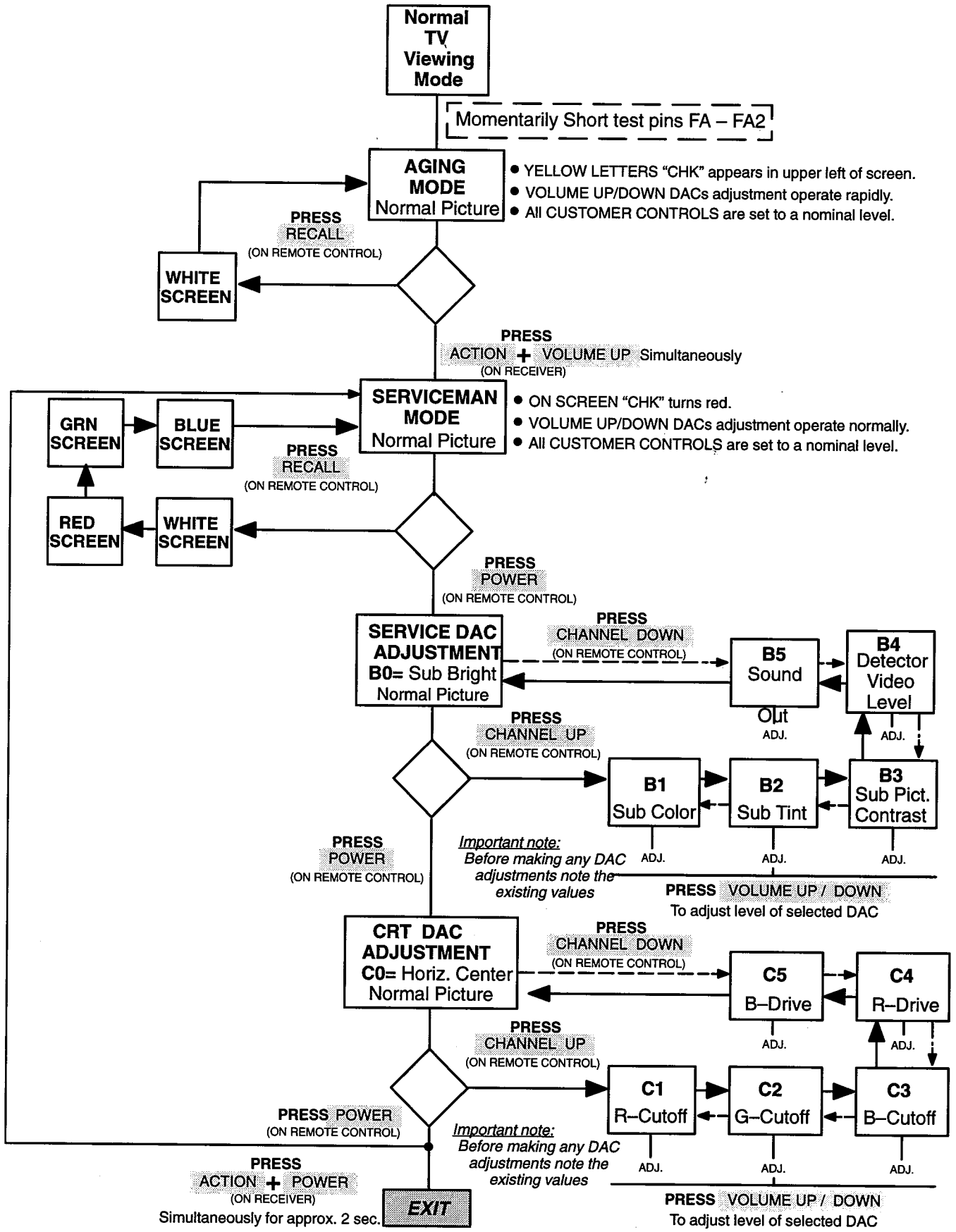
Exit Serviceman Mode:

1. Press ACTION + POWER buttons simultaneously for approximately 2 seconds.
   "The Receiver exits Serviceman Mode".

The Receiver momentarily shuts off; then comes back on tuned to channel 3 with a preset level of sound.

Instructional Flow Chart for Serviceman Mode

Caution: Always EXIT Serviceman Mode after use


Normal TV Viewing Mode
Momentarily Short test pins FA – FA2
AGING MODE Normal Picture
• YELLOW LETTERS "CHK" appears in upper left of screen.
• VOLUME UP/DOWN DACs adjustment operate rapidly.
• All CUSTOMER CONTROLS are set to a nominal level.
PRESS RECALL (ON REMOTE CONTROL)
WHITE SCREEN
PRESS ACTION + VOLUME UP Simultaneously (ON RECEIVER)
SERVICEMAN MODE Normal Picture
• ON SCREEN "CHK" turns red.
• VOLUME UP/DOWN DACs adjustment operate normally.
• All CUSTOMER CONTROLS are set to a nominal level.
GRN SCREEN
BLUE SCREEN
PRESS RECALL (ON REMOTE CONTROL)
RED SCREEN
WHITE SCREEN
PRESS POWER (ON REMOTE CONTROL)
SERVICE DAC ADJUSTMENT B0= Sub Bright Normal Picture
PRESS CHANNEL DOWN (ON REMOTE CONTROL)
B5 Sound Out
B4 Detector Video Level
ADJ.
ADJ.
PRESS CHANNEL UP (ON REMOTE CONTROL)
B1 Sub Color
B2 Sub Tint
B3 Sub Pict. Contrast
ADJ.
ADJ.
ADJ.
PRESS POWER (ON REMOTE CONTROL)
Important note: Before making any DAC adjustments note the existing values
PRESS VOLUME UP / DOWN To adjust level of selected DAC
CRT DAC ADJUSTMENT C0= Horiz. Center Normal Picture
PRESS CHANNEL DOWN (ON REMOTE CONTROL)
C5 B–Drive
C4 R–Drive
ADJ.
ADJ.
PRESS CHANNEL UP (ON REMOTE CONTROL)
C1 R–Cutoff
C2 G–Cutoff
C3 B–Cutoff
ADJ.
ADJ.
ADJ.
PRESS POWER (ON REMOTE CONTROL)
Important note: Before making any DAC adjustments note the existing values
PRESS VOLUME UP / DOWN To adjust level of selected DAC
PRESS ACTION + POWER (ON RECEIVER) Simultaneously for approx. 2 sec.
EXIT

Receiver shuts off; then turns on, TUNED TO CHANNEL 3 WITH A PRESET LEVEL OF SOUND.

Note: This will also erase any Programmed Channels, Channels Caption data and some other user defined items.

Service Adjustments (Electronic Controls)

Sub–Brightness

Serviceman DAC Adjustment (B0)

Adjustment of this control is important for getting proper operation of customer brightness and picture controls. This adjustment must be made after Sub–Contrast or Color Temperature adjustments are made. **Do not adjust** SCREEN after Sub–Brightness is set.

Preparation

1. Connect a color bar signal with 100 IRE white and 7.5 IRE black. (Switch Color "OFF" on the generator.) Operate television for a minimum of 10 minutes prior to the adjustment.

Procedure

1. In Serviceman Mode for making electronic adjustments, select DAC adjustment (B0) and adjust so the black bar starts to look grey. Then decrease the adjustment to the point where grey turns to black.

Video Detector Level

Serviceman DAC Adjustment (B4)

Preparation

1. Obtain an NTSC color bar pattern with 100 IRE white and 87.5% modulation.
2. Connect oscilloscope to TP12. Use cold ground for scope connection. Set scope at Horizontal rate (20µs) time base.

Procedure

1. In Serviceman Mode for making electronic adjustments, select DAC Adjustment (B4) and adjust for 1.7V from sync tip to white level. See detail.

2. Set SUB–CONTRAST adjustment (DAC adjustment B3).

Sub Contrast

Serviceman DAC Adjustment (B3)

This adjustment is factory set. **Do not adjust** unless repairs are made to associated circuit, the CRT Board or the CRT is replaced.

Preparation

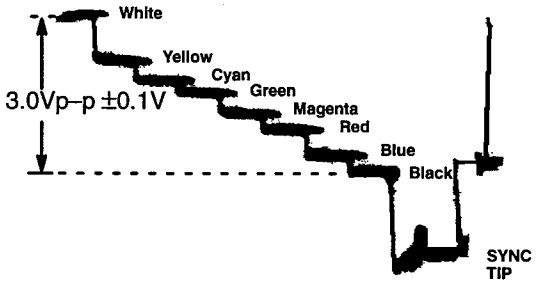
1. Connect a generator pattern with 87.5% modulation, 70% saturated color bar with a 100 IRE white and 7.5 black.

NOTE: The pattern used in this procedure is an EIA color bar pattern with 87.5% modulation with 100 IRE white and 7.5 black. Correlate the information in this procedure to your pattern used.

2. Connect oscilloscope to CRT–Board connector C1–2 (TP35). Set scope horizontal time base to 20µs (horizontal).
3. Normalize the Video Adjustments.
4. Connect jumper from TPD2 to ground (⏚).

Procedure

1. In the Serviceman Mode for electronic adjustments, select DAC Adjustment (B3) and adjust for 3.0Vp–p ±0.1V from white level to black level on video waveform (see video waveforms detail).



2. Remove jumper (Preparation step 4).

Tint/Color Adjustment

Serviceman DAC Adjustment (B2) (B1)

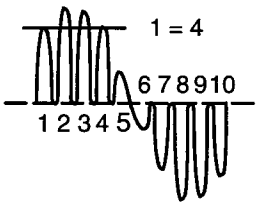
Preparation

1. Connect a rainbow color bar signal.
2. Connect oscilloscope to TP47R (A–Board) or connector C1 pin 1 (CRT–Board).
3. Normalize the Video Adjustments.
4. Connect jumper from TPD2 to GND (⏚).

Procedure

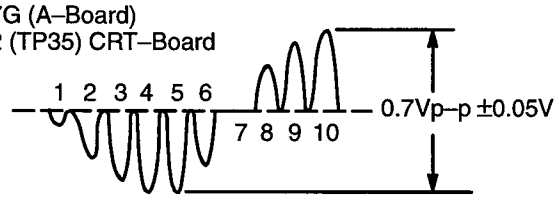
1. In serviceman Mode for making electronic adjustments, select DAC Adjustment (B2) and adjust waveform so peak 1 is the same as peak 4 as shown in the detail.

TP47R (A–Board)
C1–1 (CRT–Board)



2. Connect oscilloscope to TP47G (A–Board) or connector C1 pin 2 (TP35) CRT–Board.
3. Select DAC adjustment (B1) and adjust for peak to peak waveform to be 0.7V p–p ±0.05V.

TP47G (A–Board)
C1–2 (TP35) CRT–Board



4. Remove jumper (Preparation step 4).

Color Temperature Adjustment (B/W Tracking)

Serviceman DAC Adjust. (C1) (C2) (C3) (C4) (C5)

Minor Touch–Up Method

OBSERVE low and high brightness areas of a B/W picture for proper tracking. Adjust only as required for "good grey scale and warm highlights".

- LOW LIGHT areas – In Serviceman Mode for making electronic adjustments, select cutoff (C1) RED, (C2) GRN, (C3) BLU and adjust picture for grey.
- HIGH LIGHT areas – In Serviceman Mode for making electronic adjustments, select Drive (C4) RED, (C5) BLU and adjust for warm whites.

Complete Adjustment

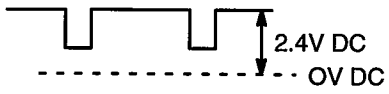
Preparation

1. Turn Receiver "ON" and allow 10 minutes warm up at high brightness.
2. Apply color bar signal with color "OFF".
3. Turn SCREEN control (part of FBT T551) fully counterclockwise.

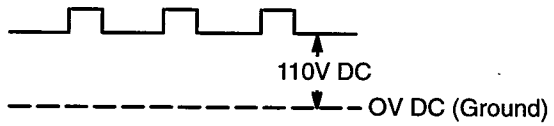
Procedure

Preset Serviceman DAC's C1, C3 level to 0 and C2 level to 128 for best results.

1. Connect oscilloscope to TP35 (CRT–Board).
2. In Serviceman Mode for making electronic adjustment, select Sub Bright (B0).
3. Connect jumper from TPS8 to FA2 (Ground ⏚).
4. Observe oscilloscope waveform at Horizontal rate and adjust Serviceman Mode Sub Bright DAC (B0) for scanning period of 2.4V above DC ground shown in detail.



5. Remove jumper. (Step 3)
6. Connect scope to GRN Cathode (KG) on CRT–Board.
7. In Serviceman Mode for making electronic adjustments, select GREEN CUTOFF DAC (C2).
8. Connect jumper from TPS8 to FA2.
9. View scope trace at Horizontal rate and adjust Serviceman Mode DAC (C2) for the scanning period to be 110V above DC ground. (See detail)
10. Remove jumper. (Step 8)
11. Connect scope to RED Cathode (KR).
12. In Serviceman Mode for making electronic adjustments, select RED CUTOFF DAC (C1).
13. Connect jumper from TPS8 to FA2.
14. View scope trace and adjust Serviceman Mode DAC (C1) for the scanning period to be 110V above DC ground. (See detail)
15. Remove jumper. (Step 13)
16. Connect scope to BLU Cathode (KB).
17. In Serviceman Mode for making electronic adjustments, select BLU CUTOFF (C3).
18. Connect jumper from TPS8 to FA2.
19. View scope trace and adjust Serviceman Mode DAC (C3) for the scanning period to be 110V above DC ground. (See detail)



Adjustment Waveform Detail (Steps 9, 14, 19)

20. Turn Screen Control (part of FBT) slowly clockwise until a color horizontal line appears slightly.
21. With the other two colors Serviceman Mode DAC CUTOFF adjustments (C1) RED, (C2) GRN, (C3) BLU; increase their colors to create a white horizontal line.
22. Remove jumper. (Step 18)
23. Confirm good gray scale by viewing B/W color bar pattern.
24 In Serviceman Mode for making electronic adjustments select DAC DRIVE adjustments (C4) RED, (C5) BLU and adjust for warm white in white color bar of pattern.
25. EXIT Serviceman Mode.
26. Adjust Picture Menu Video Adjustments BRIGHT and PICTURE from low scale to high scale and check Black and White tracking.
27. If correction needed: Re–Enter Serviceman Mode and perform **Minor Touch – Up Method.**
28. Perform SUB BRIGHTNESS adjustment procedure.

Horizontal Centering

Serviceman DAC Adjustment (C0)

Preparation

1. Connect crosshatch generator.

Procedure

1. In Serviceman Mode for making electronic adjustments. Select DAC adjustment (C0) and adjust so center of crosshatch pattern is centered on CRT screen.
2. EXIT Serviceman Adjustment Mode.

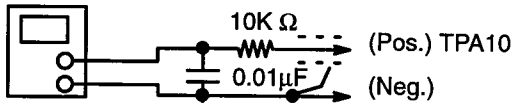
Sound Out

Serviceman DAC Adjustment (B5)

This adjustment is factory set and needs to be performed only when IC002 or IC101 is replaced.

Preparation

1. Connect 1KHz. 30% modulation (25KHz deviation) signal generator to antenna (70db ±5db, 75Ω open P/S 10db). Generator pre–emphasis must be "OFF" for 1KHz.
2. Connect Oscilloscope with filter jig as shown in detail.



Procedure

1. In Serviceman Mode for making electronic adjustments, select DAC adjustment (B5) and adjust for 100mV rms ± 10mV rms (282.8mV p–p)
2. EXIT Serviceman Adjustment Mode.

Service Adjustments (Mechanical Controls)

RF AGC Delay R106

Adjust only if overloading on strong signal or busy background (snow) is present on moderate strength signals.

1. Adjust RF AGC control R106 until snow appears in picture, then adjust control until snow is eliminated.
2. Check all channels for optimum setting.

AFC Field Adjustment L103

1. Select TV signal mode with Menu.
2. Defeat AFC by applying jumper from TPS7 (R063) to ground (⏚).
3. Connect a digital voltmeter to AFC test point TP16.
4. Use Remote Control to Check all active High Band channels 7~13 for AFC voltage range. Select channel with AFC voltage in approximate center of voltage range.
5. Adjust L103 for 4.6V ±0.5V at TP16.
6. Check all active channels for proper AFC correction. Touch up L103 if required. Remove jumper in step 2.

NOTE: Do not use TV/CABLE channel with offset carriers for adjustment or in determination of low and high range of AFC voltage.

Sound Alignment L201

1. Select active TV channel.
2. Attenuate signal (loosely couple antenna lead or use RF attenuator pad) for noisy sound.
   - Adjust L201 for Maximum sound. Signal to noise ratio is best when L201 is peaked.
3. Connect antenna or remove RF attenuator for strong signal.

Vertical Size R453

1. Turn VERTICAL SIZE control R453 CCW until top and bottom edges of raster are visible.
2. Adjust VERTICAL SIZE control CW until top and bottom of raster touch bezel edge. Advance SIZE control CW an additional 30 degrees. This will be approximately 10% overscan. Linearity adjustment is automatic with size adjustment.

Focus (Part of T551)

Preparation

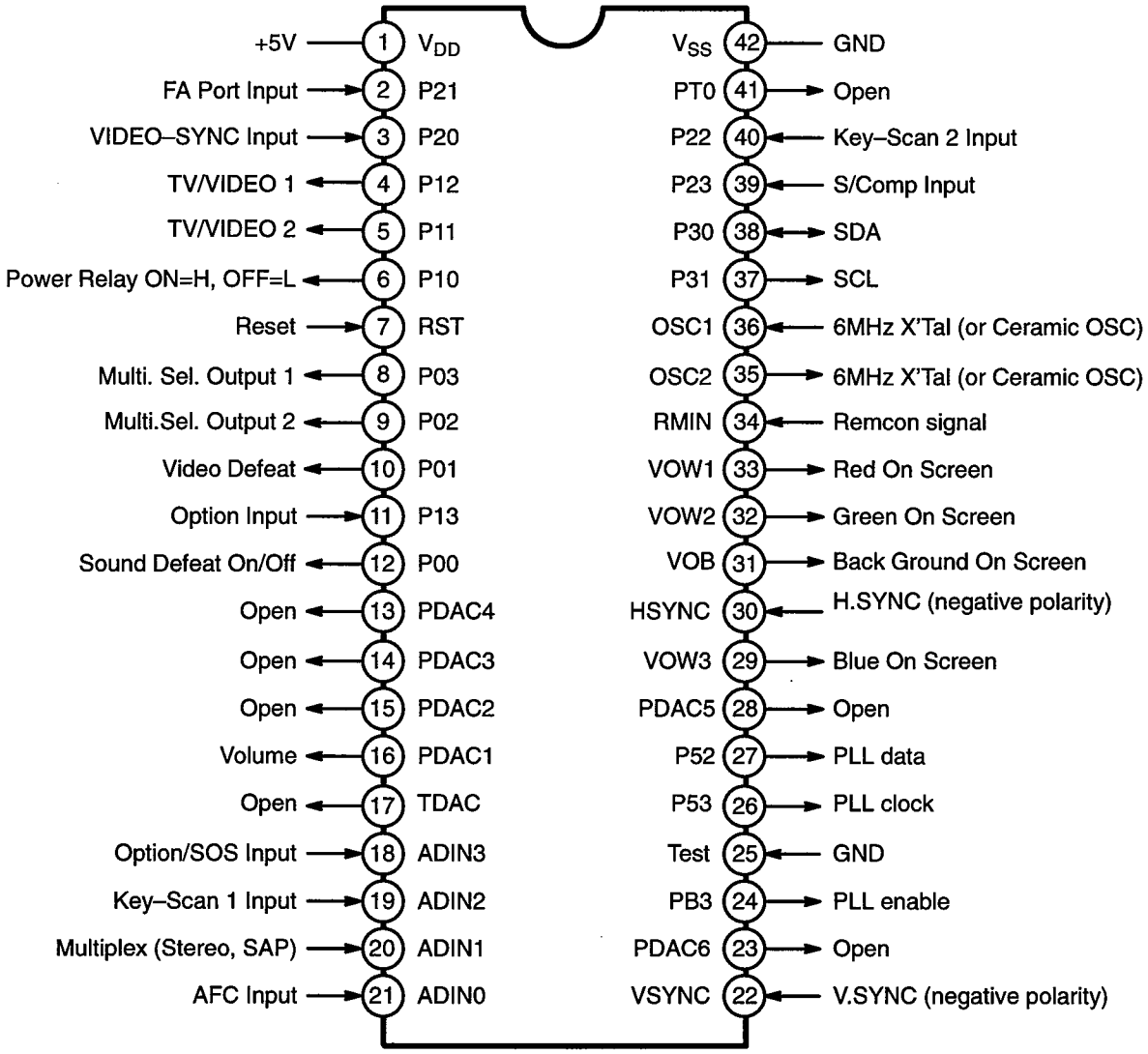
1. Connect Signal generator and select dot pattern.

Procedure

1. Adjust the FOCUS control to obtain the sharpest and clearest dot pattern.
   (a) adjust for best center.
   (b) adjust for best area between center and top right corner.

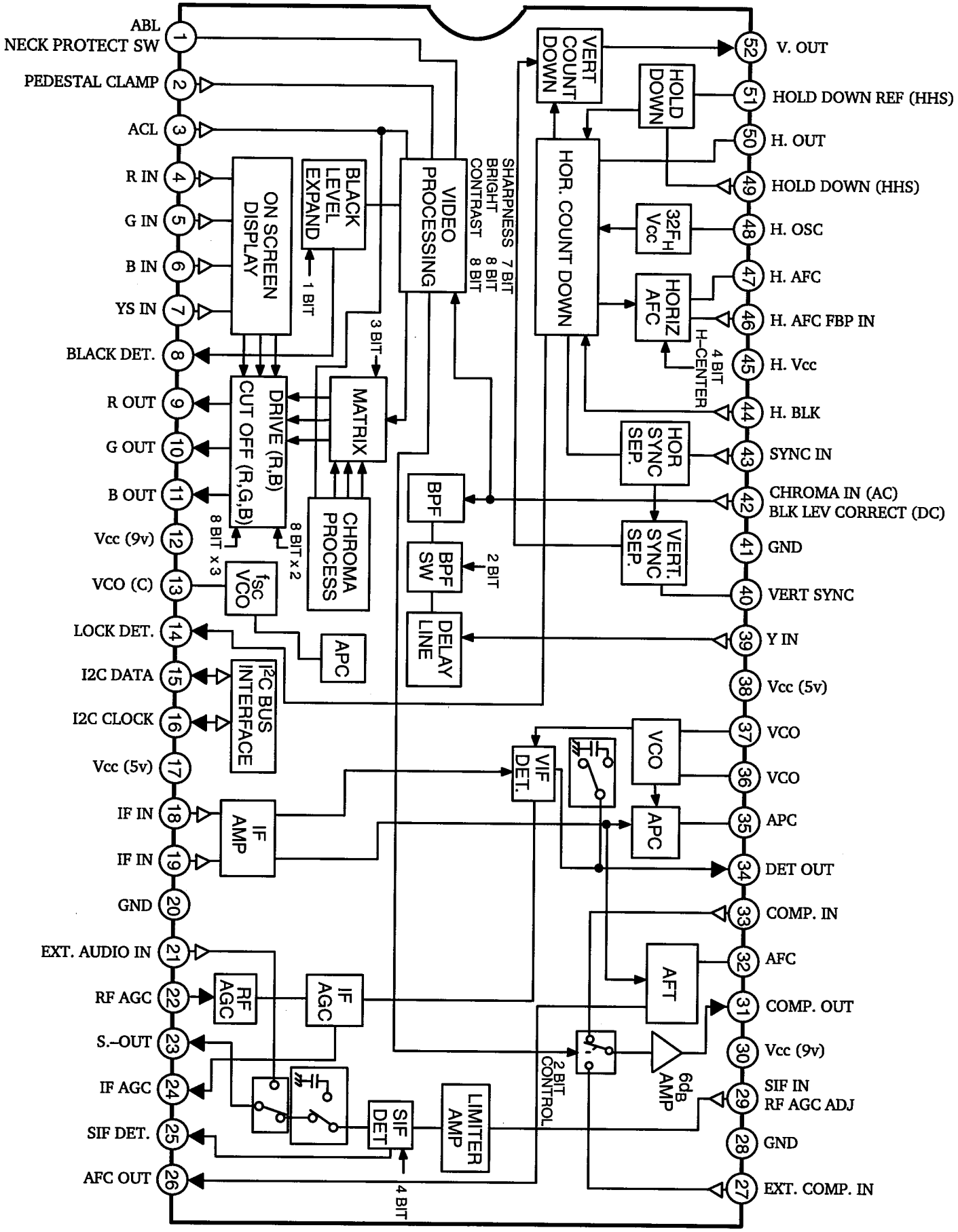
New Circuits

IC001 MPU IN/OUT Pins and Functions


+5V 1 VDD
FA Port Input 2 P21
VIDEO–SYNC Input 3 P20
TV/VIDEO 1 4 P12
TV/VIDEO 2 5 P11
Power Relay ON=H, OFF=L 6 P10
Reset 7 RST
Multi. Sel. Output 1 8 P03
Multi.Sel. Output 2 9 P02
Video Defeat 10 P01
Option Input 11 P13
Sound Defeat On/Off 12 P00
Open 13 PDAC4
Open 14 PDAC3
Open 15 PDAC2
Volume 16 PDAC1
Open 17 TDAC
Option/SOS Input 18 ADIN3
Key–Scan 1 Input 19 ADIN2
Multiplex (Stereo, SAP) 20 ADIN1
AFC Input 21 ADIN0
VSS 42 GND
PT0 41 Open
P22 40 Key–Scan 2 Input
P23 39 S/Comp Input
P30 38 SDA
P31 37 SCL
OSC1 36 6MHz X'Tal (or Ceramic OSC)
OSC2 35 6MHz X'Tal (or Ceramic OSC)
RMIN 34 Remcon signal
VOW1 33 Red On Screen
VOW2 32 Green On Screen
VOB 31 Back Ground On Screen
HSYNC 30 H.SYNC (negative polarity)
VOW3 29 Blue On Screen
PDAC5 28 Open
P52 27 PLL data
P53 26 PLL clock
Test 25 GND
PB3 24 PLL enable
PDAC6 23 Open
VSYNC 22 V.SYNC (negative polarity)

IC101 Block Diagram

INPUT PINS = ▽ △ OUTPUT PINS = ▲ ▼

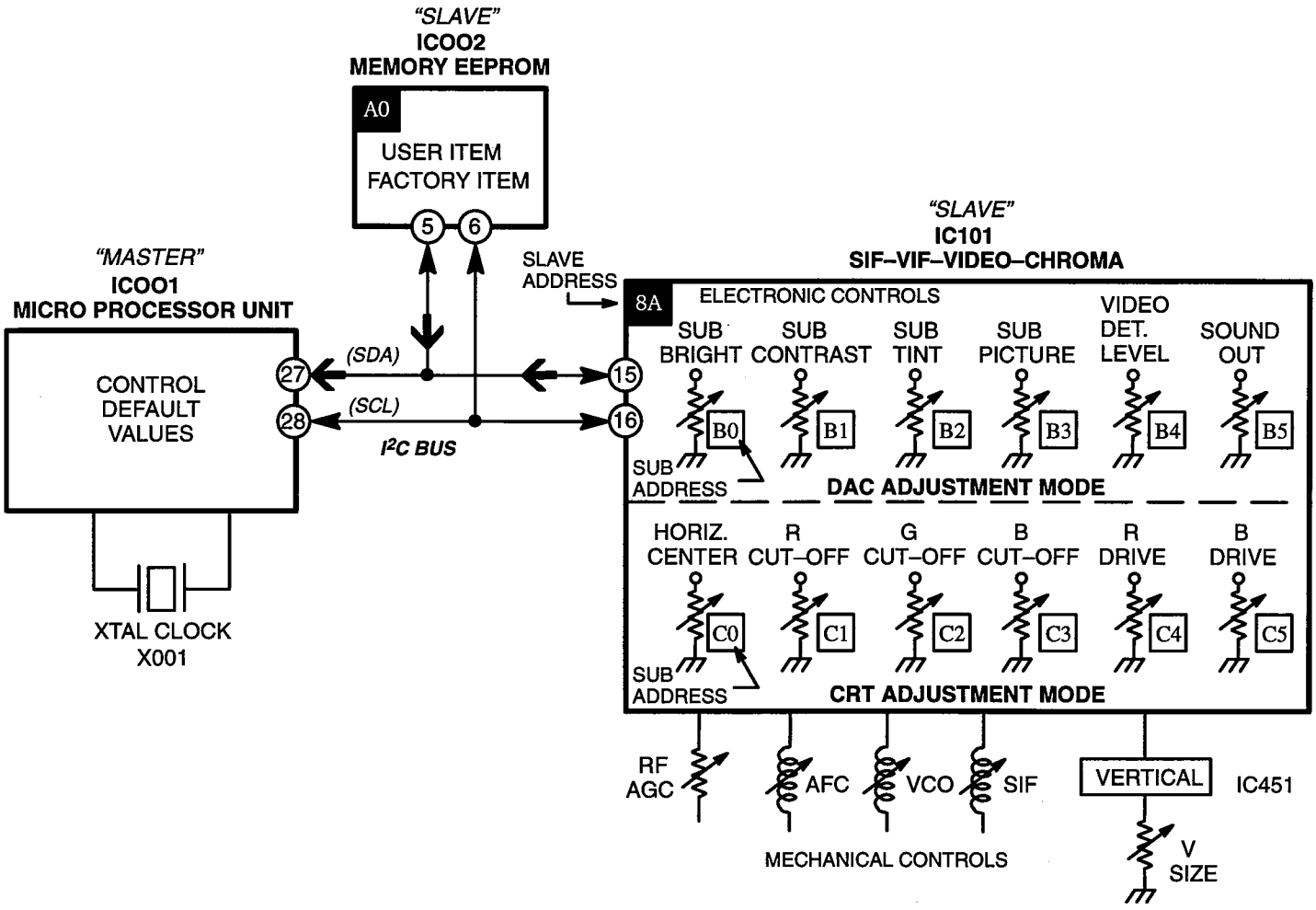


I²C Bus Line System

This Receiver makes use of one of the latest electronic technologies by using an I²C (Inter–Integrated Circuit) Bus Line Concept. Two wires, SDA (Serial Data) and SCL (Serial Clock) carry information between devices connected to the Bus. Each device connected to the Bus has a unique address for receiving data information (a Receiver) from a source (the Transmitter).

The devices are also considered to be a "Master" or a "Slave" when data is transmitted or received. In this Receiver, the "Master" (Micro Processor Unit, I C001) is the device which initiates a data transfer in the Bus line and generates the clock signal required to permit the data to be sent. The "Slaves" (MEMORY I²C EEPROM, IC002 and VIF–SIF–VIDEO–CHROMA JUNGLE, IC101) are the devices addressed by the MPU and receive the data transmitted.

This system usually performs as a control function and replaces many of the required mechanical controls needed in a television receiver. Instead of adjusting various mechanical controls individually, many of the control functions can be performed electronically using "On Screen Menus", (The Serviceman Mode).



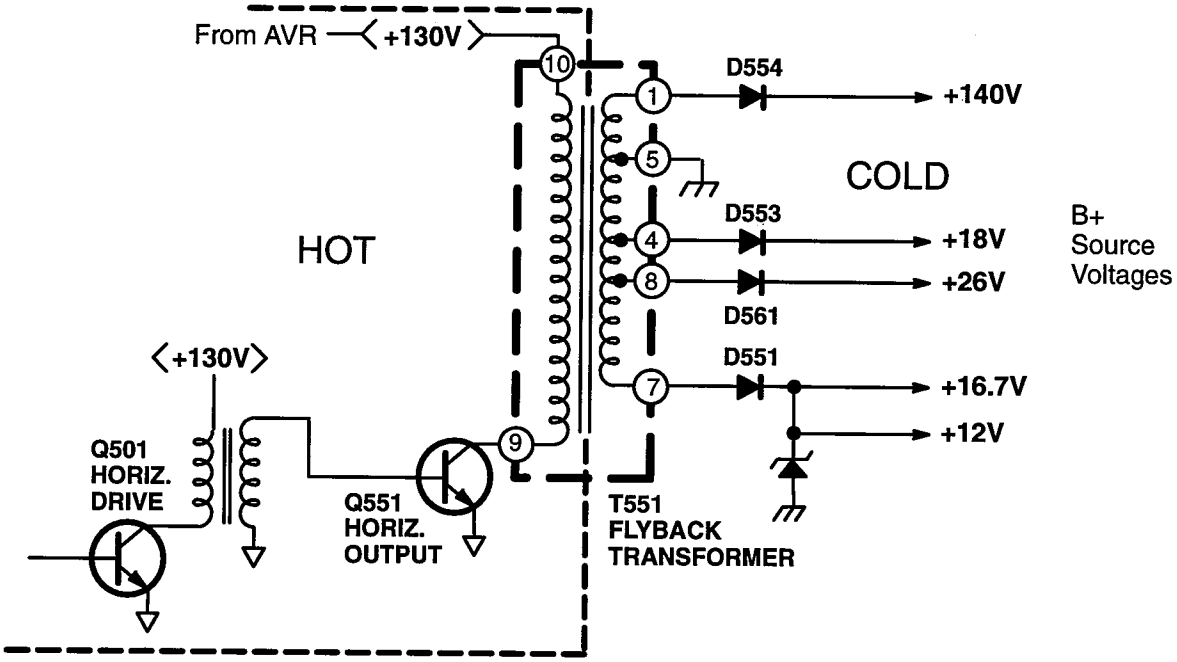
AVR Power Supply

B+ Source Voltages

The NA3A Chassis B+ source voltages are derived from secondary windings on the flyback transformer (T551).

B+ for the Horizontal Drive, Horizontal Output (Q501/Q551) and Flyback Transformer (T551) is supplied by an AVR (Automatic Voltage Regulator) 130 volt output. Since the secondary B+ voltages are dependant on scan waveform or flyback pulse amplitude, these voltages are also regulated for AC line and/or load variations.

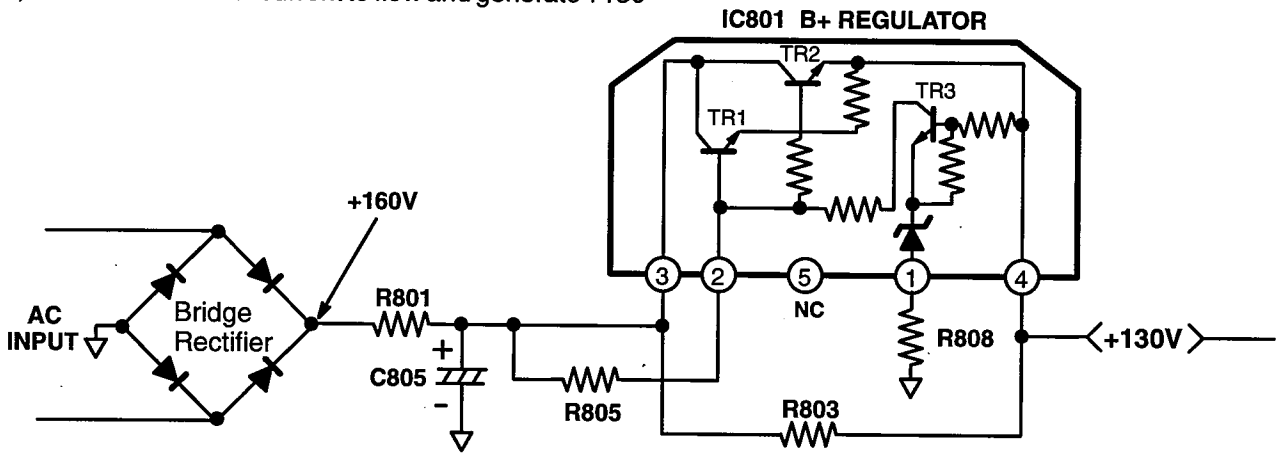
The +18 volt, +16.7 volt and +26 volt supplies are derived by diode rectification of the scan waveform and are relatively high current supplies. The 16.7 volt B+ source is also clamped by zener diode D090 and supples +12 volt B+ to most of the Main Board circuitry. The +140 volt is developed from diode rectification of the flyback pulse.



Automatic Voltage Regulation

The AVR (IC801) detects the variations of its output and corrects any changes to +130 volts. +160 volts from the full wave bridge rectifier is applied to the collector of internal TR1 and TR2. (IC801 pin 3.) This voltage is also applied to the base of TR1 and TR2. (IC801 pin 2) The base voltage TR1, TR2 causes emitter current to flow and generate +130 volts output. (IC801 pin 4.)

If for some reason, output voltage increases, the base voltage of TR3 also increases. The collector voltage of TR3 decreases. The base voltage of TR1 and TR2 will decrease and the output voltage is reduced.



Follow the chart below to observe IC801 voltage regulation. ↗ = voltage increase, ↘ = voltage decrease.

Output Voltage Before Correction	TR3 Base	TR3 Collector	TR1/TR2 Base	Output Voltage After Correction
HIGH	↗	↘	↘	+130V
Normal +130V				+130V
LOW	↘	↗	↗	+130V

3303 342

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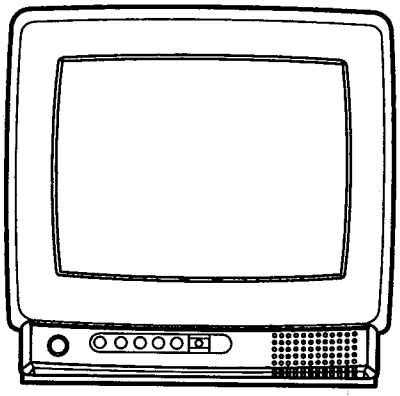
PQ1

Service Manual

Color Television

Supplement

Panasonic Models	Chassis
CT–9R10T	ADP243
CT–9R10CT	ANDP243
CT–9R20T	AMDP243
Quasar Model	**Chassis**
TP917T	ALDC243



Supplement (NA4)

Reprint of Schematics

Specifications

Remote Control:	Infra–red System
	Panasonic Easicon
	EUR501332 (CT–9R10T, CT)
	EUR501333 (CT–9R20T)
	Quasar Easy Icon
	EUR501342 (TP917T)
Picture Tube:	9" diagonal (Viewing area)
	90 degree deflection
	A23KQU22X
Anode Voltage:	19.0kV Max. (Zero beam)
	18.0kV ± 1.0kV
Dimensions & Weight:	
Height:	11 – 1/32" (280mm)
Width:	11 – 27/32" (301mm)
Depth:	10 – 41/64" (270mm)
Weight:	14 lbs (6.4Kg)

Power Source:	120 volts, 60 Hz, AC
Power Consumption:	0.75 amps Max
AC/DC Power Source:	120 volts, 60 Hz, AC
Model CT–9R20T	12V DC (car battery)
Power Consumption:	AC 0.75 amp Max.
Model CT–9R20T	DC 6.0 amps Max.
Antenna Terminal Impedance:	(1) UHF/VHF 75Ω input
Channel Capability:	181 Channels (Phase 20 Synthesizer)
Off the Air:	VHF 2~13, UHF 14~69
Cable:	125 Channels
Sound Output:	1.5W (10% distortion)

Specifications are subject to change without notice or obligation.
Dimensions and weight are approximate measurements.

The service technician is required to read and follow the "Safety Precautions" and "Important Safety Notice" in this manual.

"WARNING! This Service Manual is designed for experienced repair technicians only and is not designed for use by the general public. It does not contain warnings or cautions to advise non–technical individuals of potential dangers in attempting to service a product. **Products powered by electricity should be serviced or repaired only by experienced professional technicians.** Any attempt to service or repair the product or products dealt with in this Service Manual by anyone else could result in serious injury or death."

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Horizontal Hold Down Circuit

This circuit protects against excessive high voltage and CRT beam current. If for any reason high voltage and/or CRT beam current exceeds a predetermined level, the Hold Down Circuit operates to increase horizontal frequency. If the level increases more, the Hold Down Circuit will blank the CRT.

CRT heater voltage from pin 6 of flyback transformer (FBT) T551 is rectified by diode D531. This voltage is directly proportional to high voltage variations. The voltage is filtered and divided down by precision resistors R532/R533 to approximately 2.4V and applied to Pin 49 (Hold Down) of IC101. With this voltage as a normal condition, the Hold Down Circuit is inactive and has no effect on horizontal frequency or blanking the CRT.

The Hold Down Circuit inside IC101 is a (NPN) differential amp. One base of the differential amp is connected to Pin 49 (approximately 2.4V). The other is connected to Pin 51 through an internal voltage divided of equal resistance. Pin 51 is clamped at a 6V DC reference voltage by zener diode D532. The voltage at the base of the differential amp is 3V. (1/2 of the reference voltage, 6V)

Basically, the Hold Down Circuit compares the voltage at Pin 49 (approximately 2.4V) to half of Pin 51 (clamped 6V). If CRT heater pulse amplitude from T551 (representative of high voltage) increases, the positive voltage at the cathode of D531 and at Pin 49 of IC101 also increase.

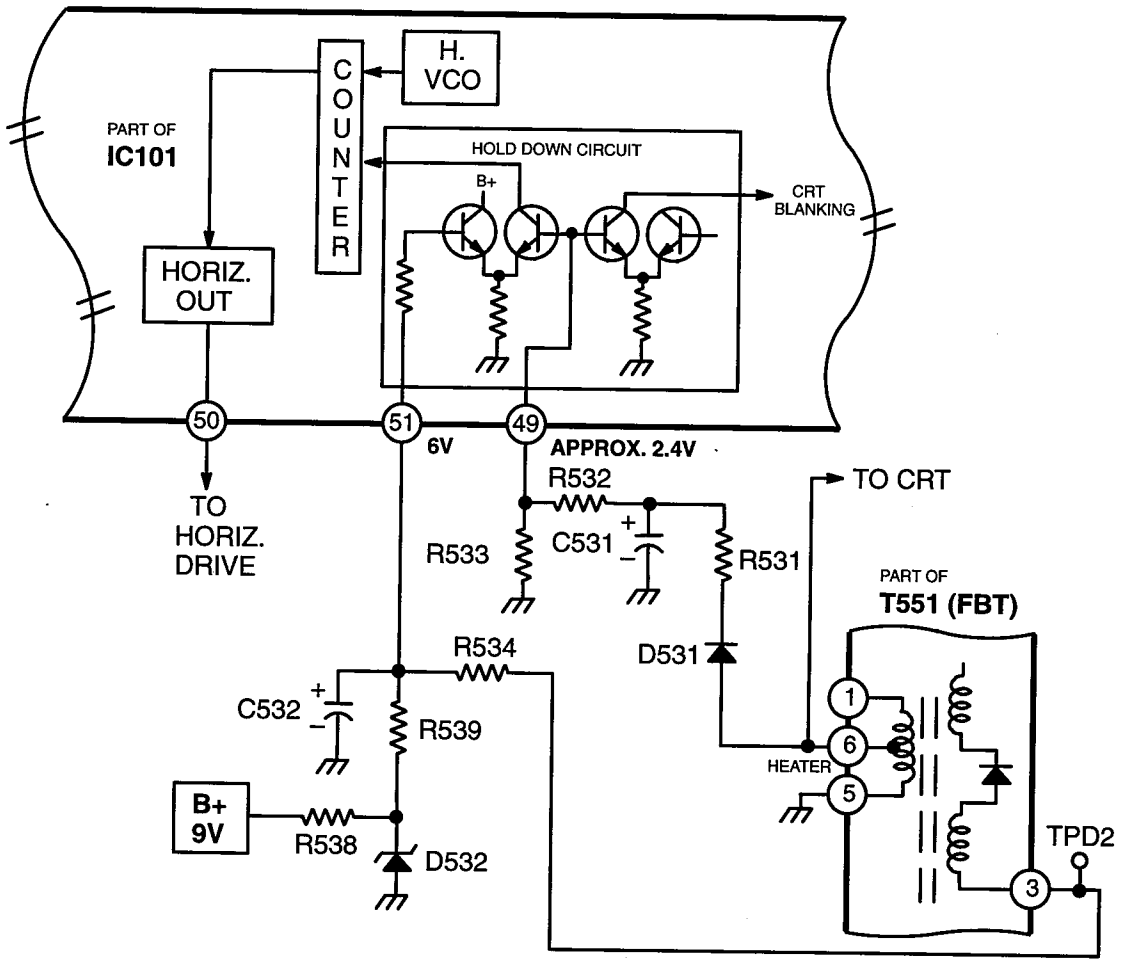
When the increased DC voltage at Pin 49 exceeds half of the Pin 51 reference voltage by a predetermined amount, the Hold Down Circuit (differential amp) changes conduction state and shifts the horizontal count down for a higher sweep frequency (out of sync condition) to prevent unsafe operation. For further safety when the Pin 49 voltage is extremely excessive, another internal differential amp changes state to blank the CRT.

An increase in CRT beam current produces more negative ABL voltage at Pin 3 of T551 (FBT) which is coupled to Pin 51 of IC101 via resistor R534. This increased negative voltage opposes the positive voltage at Pin 51 and lowers the DC reference voltage to less than 6V. This in turn causes the Hold Down Circuit to operate sooner when Pin 49 voltage increases.

Thus excessive levels of high voltage and/or increased CRT beam current cause determining of the horizontal oscillator frequency and eventual blanking of the CRT to assure operation within safe limits.

The B+ circuit and the Hold Down Circuit are not adjustable. If components in the designated areas of the schematic for critical parts are changed, operation of the Hold Down Circuit must be checked to insure that high voltage and CRT beam current does not exceed safe operation parameters. Check the following for possible failure:

1. Measure the DC voltage at Pin 49 of IC101 (reading should be close to +2.4V). If not, check D531, R531, C531, R532, R533 and IC101.
2. Measure the DC voltage at Pin 51 of IC101. (reading should be +6V) if not, check R534, C532, R539, D532, R538 and IC101.



CRT Protection Circuit

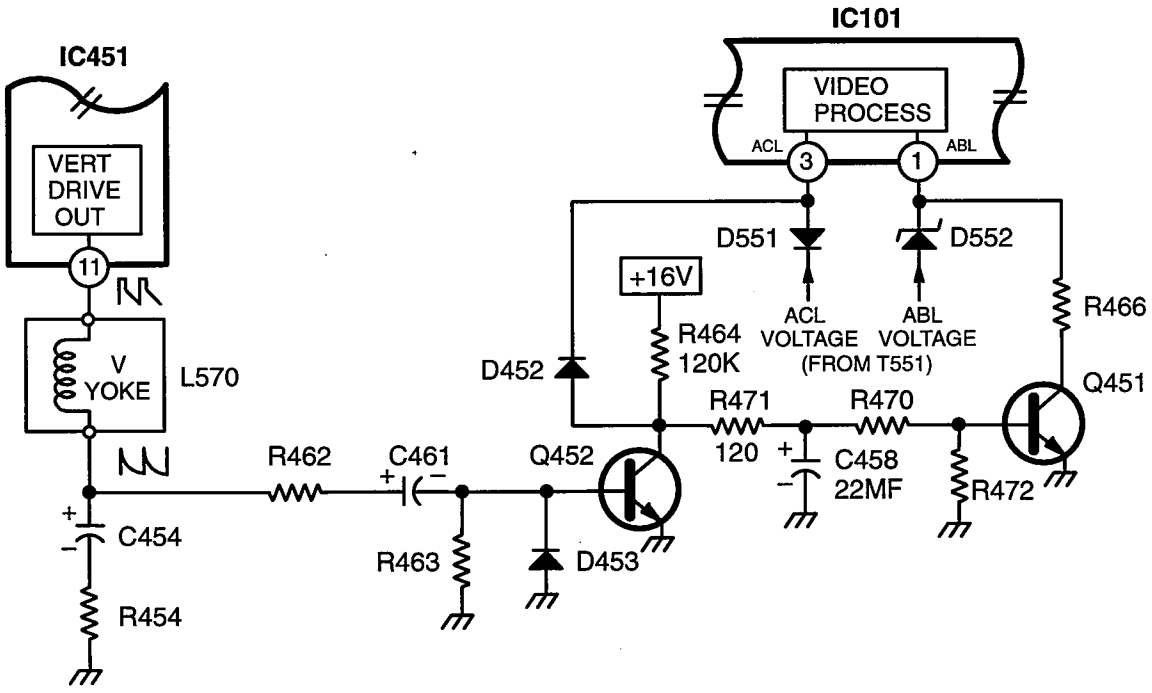
The CRT Protection Circuit is made up of transistors Q452 and Q451. The circuit blanks the CRT in the event of vertical sweep loss.

During normal operation, Q452 monitors vertical sweep by being connected to the low side of the vertical yoke L570. When Q452 is off, C458 starts to charge up from the 16V source through resistors R464 and R471. The RC time constant is such that the charging is slow. When Q452 is conducting, C458 discharges through R471 and the transistor to ground. The RC time constant is such that the discharge is fast. The slow charging and fast discharging along with voltage divider R470/R472 prevents sufficient bias for transistor Q451 to conduct. With Q451 not conducting, Pin 1 of IC101 is high and ABL functions normally.

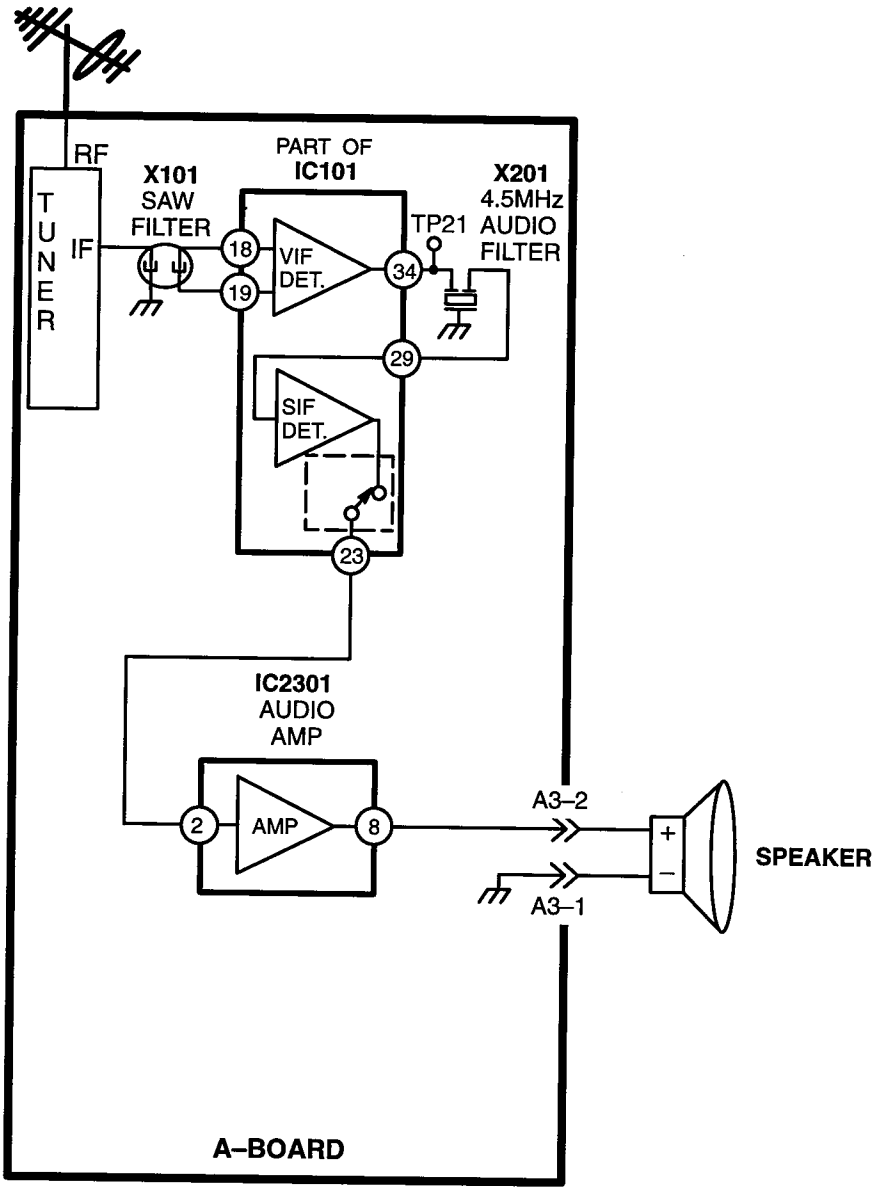
If yoke current ceases (due to an open yoke or no voltage at IC451 Pin 11), there is no base bias for transistor Q452. The transistor is now always non conductive. Capacitor C458 is now allowed to charge a longer time to supply enough bias through voltage divider R470/R472 for Q451 to conduct. When it does, the voltage at Pin 1 of IC101 goes low and cuts off CRT beam current.

Diode D452 is added to the collector of Q452 to prevent the circuit from operation when Pin 3 of IC101 is grounded for Service Switch function when setting CRT cutoff.

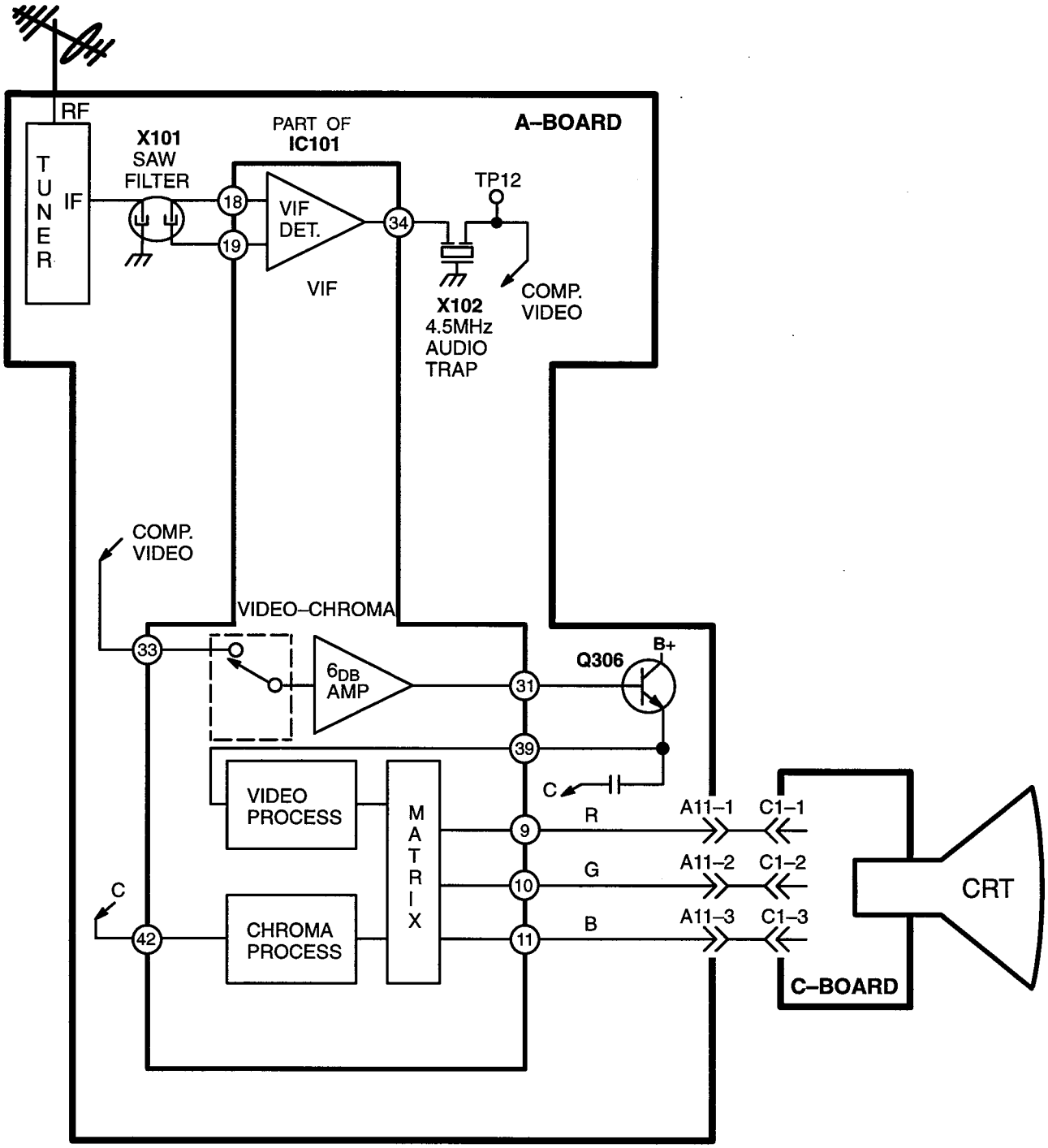
It is important for CRT life that this circuit be checked before returning a repaired receiver to a customer. A quick test is to short Q452 base to ground. The CRT should blank. If not, troubleshoot the circuit for cause.



Audio Signal Path Block Diagram



Video–Chroma Signal Path Block Diagram



REPLACEMENT PARTS LIST

Important Safety Notice: Components printed in **BOLD TYPE** have special characteristics important for safety. When replacing any of these components use only manufacturer's specified parts.

REF. NO.	PART NO.	DESCRIPTION
		CAPACITORS
C001	ECUX1H103ZFX	CAP,C .01UF–Z–50V
C002	ECEA1EKA4R7	CAP,E 4.7UF/25V
C007	ECUX1H101KCX	CAP,C 100PF–K–50V
C008	ECUX1H103ZFX	CAP,C .01UF–Z–50V
C011	ECUX1H103ZFX	CAP,C .01UF–Z–50V
C012	ECEA1HKA3R3	CAP,E 3.3UF/50V
C013	ECUX1H103ZFX	CAP,C .01UF–Z–50V
C014	ECEA0JKA470	CAP,E 47UF/6.3V
C021	ECUX1H221KBX	CAP,C 220PF–K–50V
C025	**ECEA1CU470**	**CAP,E 47UF/16V**
C026	ECEA1CU102	CAP,E 1000UF/16V
C027	ECEA1CU470	CAP,E 47UF/16V
C028	ECEA1HKA4R7	CAP,E 4.7UF/50V
C032	ECUX1H103ZFX	CAP,C .01UF–Z–50V
C036	ECUX1H101KCX	CAP,C 100PF–K–50V
C038	ECUX1H103ZFX	CAP,C .01UF–Z–50V
C039	ECEA0JKA101	CAP,E 100UF/6.3V
C045	ECEA1CU471	CAP,E 470UF/16V
C050	ECUX1H101KCX	CAP,C 100PF–K–50V
C051	ECUX1H101KCX	CAP,C 100PF–K–50V
C052	ECUX1H221KBX	CAP,C 220PF–K–50V
C053	ECUX1H221KBX	CAP,C 220PF–K–50V
C101	ECUX1H103ZFX	CAP,C .01UF–Z–50V
C102	ECEA1CKA100	CAP,E 10UF/16V
C103	ECUX1H103ZFX	CAP,C .01UF–Z–50V
C104	ECEA1HKA0R1	CAP,E .1UF/50V
C105	ECUX1H270JCX	CAP,C 27PF–J–50V
C106	ECUX1H122KBX	CAP,C .0012UF–J–50V
C107	ECEA1HKAR47	CAP,E .47UF/50V
C108	ECEA1CKA100	CAP,E 10UF/16V
C109	ECEA0JU331	CAP,E 330UF/6.3V
C110	ECUX1H103ZFX	CAP,C .01UF–Z–50V
C113	ECEA1CKA100	CAP,E 10UF/16V
C118	ECUX1H103ZFX	CAP,C .01UF–Z–50V
C151	ECEA1HKAR22	CAP,E .22UF/50V
C152	ECUX1H680JCX	CAP,C 68PF–J–50V
C153	ECUX1H150JCX	CAP,C 15PF–J–50V
C201	ECUX1H560JCG	CAP,C 56PF–J–50V
C202	ECUX1H103ZFX	CAP,C .01UF–Z–50V
C203	ECUX1H103ZFX	CAP,C .01UF–Z–50V
C206	ECUX1H153KBX	CAP,C .015UF–K–50V
C207	ECEA1CKA100	CAP,E 10UF/16V
C301	ECEA1CKA100	CAP,E 10UF/16V
C302	ECEA1AU331	CAP,E 330UF/10V
C303	ECEA1EKA4R7	CAP,E 4.7UF/25V
C304	ECEA1EKA4R7	CAP,E 4.7UF/25V
C305	ECEA1HKAR33	CAP,E .33UF/50V
C306	ECCF1H270JC	CAP,C 27PF–J–50V
C306	ECEA1HKA010	CAP,E 1.0UF/50V
C312	ECEA1CKA220	CAP,E 22UF/16V
C351	ECUX1H181JCX	CAP,C 180PF–J–50V
		CT–9R10TM CT–9R10CTM
		TP917TM
C352	ECUX1H221JCX	CAP,C 220PF–J–50V
		CT–9R10TM CT–9R10CTM
		TP917TM
C353	ECUX1H271JCX	CAP,C 270PF–J–50V
		CT–9R10TM CT–9R10CTM
		TP917TM
C355	ECKD3D681KB	CAP,C 680PF–K–2KV
		CT–9R10TM CT–9R10CTM
		TP917TM
C358	ECEA1HKA010	CAP,E 1.0UF/50V
		CT–9R10TM CT–9R10CTM
		TP917TM
C401	ECEA1HKAR33	CAP,E .33UF/50V
C402	ECUX1H681KBX	CAP,C 680PF–K–50V
C403	ECEA1HKA010	CAP,E 1.0UF/50V
C451	ECEA1CGE101	CAP,E 100UF/16V
C452	ECSF1CE105VB	CAP,T 1.0UF/16V
		CT–9R20TM
C452	ECSF1EE105	CAP,T 1.0UF/25V
		CT–9R10TM CT–9R10CTM
		TP917TM
C453	ECEA1HFS3R3	CAP,E 3.3UF/50V
C454	ECEA1EGE102	CAP,E 1000UF/25V
C455	ECEA1VU470	CAP,E 47UF/35V
C456	ECUX1H473ZFX	CAP,C .047UF–Z–50V
C457	ECEA1HGE0R1	CAP,E .1UF/50V
C458	ECEA1EKA4R7	CAP,E 4.7UF/25V
C461	ECEA1HKA010	CAP,E 1.0UF/50V
C502	ECEA1HKA010	CAP,E 1.0UF/50V
C503	ECQB1H333KF	CAP,P .033UF–K–50V
C504	ECUX1H103ZFX	CAP,C .01UF–Z–50V
C505	ECQB1H153KF	CAP,P .015UF–K–50V
C506	ECEA1AU221	CAP,E 220UF/10V
C507	ECUX1H221KBX	CAP,C 220PF–K–50V
C508	ECQB1H223KF	CAP,P .022UF–K–50V
C509	ECCF1H221JU	CAP,C 220PF–J–50V
C511	ECKD2H821KB	CAP,C 820PF–K–500V
C531	**ECEA1VU220**	**CAP,E 22UF/35V**
C532	**ECEA1EKA4R7**	**CAP,E 4.7UF/25V**
C541	ECUX1H122JCX	CAP,C .0012UF–J–50V
C552	**ECEA1EU221**	**CAP,E 220UF/25V**
C554	**ECKD2H561KB**	**CAP,C 560PF–K–500V**
C555	**ECEA2CU220**	**CAP,E 22UF/160V**
C559	**ECA1EM221GB**	**CAP,E 220UF/25V**
C561	ECEA2AU2R2	CAP,E 2.2UF/100V
C562	**ECKD2H561KB**	**CAP,C 560PF–K–500V**
C563	**TAC4S6B332JC**	**CAP,P 3300PF–J–1200VH**
C564	**TAC4S6B332JC**	**CAP,P 3300PF–J–1200VH**
C567	**ECA1VM331GB**	**CAP,E 330UF/35V**
C569	**ECQF2H184JS**	**CAP,P .18UF–J–200V**
C570	**ECKD2H561KB**	**CAP,C 560PF–K–500V**
C576	ECUX1H103ZFX	CAP,C .01UF–Z–50V
C601	ECUX1H101JCG	CAP,C 100PF–J–50V
C602	ECUX1H150JCX	CAP,C 15PF–J–50V
C607	ECUX1H101JCG	CAP,C 100PF–J–50V
C615	ECUX1H470KCX	CAP,C 47PF–K–50V
C616	ECUX1H470KCX	CAP,C 47PF–K–50V
C617	ECUX1H470KCX	CAP,C 47PF–K–50V

REPLACEMENT PARTS LIST

Important Safety Notice: Components printed in **BOLD TYPE** have special characteristics important for safety. When replacing any of these components use only manufacturer's specified parts.

REF. NO.	PART NO.	DESCRIPTION
C801	ECKD2H472PU	CAP,C .0047UF–P–500V
C803	ECKD2H472PU	CAP,C .0047UF–P–500V
C804	ECKD2H472PU	CAP,C .0047UF–P–500V
C805	EC0S2DA221B4	CAP,E 220UF/200V
C806	ECEA2CGE100	CAP,E 10UF/160V
C811	ECEA1HKA3R3	CAP,E 3.3UF/50V
C812	**ECEA160V33Z**	**CAP,E 33UF/160V**
C816	ECEA0JU101	CAP,E 100UF/6.3V
C817	ECQU1A153KH	CAP,P .015UF–K–125VAC
		CT–9R20TM
C817	ECQU2A153MN	CAP,P .015UF–M–250VAC
		CT–9R10TM CT–9R10CTM
		TP917TM
C818	ECQU1A153KH	CAP,P .015UF–K–125VAC
		CT–9R20TM
C818	ECQU2A153MN	CAP,P .015UF–M–250VAC
		CT–9R10TM CT–9R10CTM
		TP917TM
C821	ECQU2A224MN	CAP,P .22UF–M–250VAC
		CT–9R20TM
C821	ECQU2A823MN	CAP,P .082UF–M–250VAC
		CT–9R10TM CT–9R10CTM
		TP917TM
C851	ECEA1VF102X	CAP,E 1000UF/35V
		CT–9R20TM
C853	ECKD2H331KB	CAP,C 330PF–K–500V
		CT–9R20TM
C854	ECEA2CU101	CAP,E 100UF/160V
		CT–9R20TM
C855	ECEA1EU471	CAP,E 470UF/25V
		CT–9R20TM
C856	ECQB1H472KF	CAP,P .0047UF–K–50V
		CT–9R20TM
C857	ECEA1HU3R3	CAP,E 3.3UF/50V
		CT–9R20TM
C858	ECKF1H471KB	CAP,C 470PF–K–50V
		CT–9R20TM
C859	ECKF1H103ZF	CAP,C .01UF–Z–50V
		CT–9R20TM
C860	ECEA1CU470	CAP,E 47UF/16V
		CT–9R20TM
C861	ECQE2225KS	CAP,P 2.2UF–K–250V
		CT–9R20TM
C862	ECQB1H823KF	CAP,P .082UF–K–50V
		CT–9R20TM
C863	ECCF1H330J	CAP,C 33PF–J–50V
		CT–9R20TM
C864	ECKD2H472KB	CAP,C .0047UF–K–500V
		CT–9R20TM
C866	ECKD2H103KB	CAP,C .01UF–K–500V
		CT–9R20TM
C867	ECQB1H683JF	CAP,P .068UF–J–50V
		CT–9R20TM
C868	ECKF1H102KB	CAP,C .001UF–K–50V
		CT–9R20TM
C870	ECKF1H121KB	CAP,C 120PF–K–50V
		CT–9R20TM
C871	ECKF1H103ZF	CAP,C .01UF–Z–50V
		CT–9R20TM
C885	ECKF1H391KB	CAP,C 390PF–K–50V
		CT–9R20TM
C2302	ECEA1CKA220	CAP,E 22UF/16V
C2304	ECEA1CKA470	CAP,E 47UF/16V
C2305	ECEA1EU471	CAP,E 470UF/25V
C2306	ECEA1CKA100	CAP,E 10UF/16V
C2307	ECQB1H683KF	CAP,P .068UF–K–50V
C2308	ECQB1H124JF	CAP,P .12UF–K–50V
C2309	ECEA1CU101	CAP,E 100UF/16V
		DIODES
D002	1N4532	DIODE
D003	MA1051L	DIODE
D011	ERA15–01	DIODE
D012	MA165	DIODE
		CT–9R20TM
D020	MA165	DIODE
D022	MA150	DIODE
D040	MA165	DIODE
		CT–9R20TM
D088	MA165	DIODE
D089	MA4240H	DIODE
D090	MA1120M	DIODE, ZENER
D308	MA165	DIODE
D401	MA4120M	DIODE
D451	ERA15–01	DIODE
D452	MA165	DIODE
D453	MA165	DIODE
D501	MA4082M	DIODE
D504	MA165	DIODE
		CT–9R20TM
D531	**AS01**	**DIODE**
D532	**MA4062L**	**DIODE, ZENER**
D543	MA4051M	DIODE, ZENER
D551	**TVSRU2N**	**DIODE**
D553	**AS01**	**DIODE**
D554	**AS01**	**DIODE**
D555	MA165	DIODE
D557	MA2051	DIODE
D560	MA2091	DIODE
D561	**AS01**	**DIODE**
D562	MA165	DIODE
D801	EM02BM	DIODE
D802	EM02BM	DIODE
D803	EM02BM	DIODE
D804	EM02BM	DIODE
D805	TAP104XM07	DIODE
		CT–9R10TM CT–9R10CTM
		TP917TM
D806	ERZV07D361	VARISTOR
D807	ERC13–08V3	DIODE
D808	MA4051H	DIODE, ZENER
D809	MA165	DIODE
D811	MA2062B	DIODE

REPLACEMENT PARTS LIST

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REF. NO.	PART NO.	DESCRIPTION
D817	ERZV07D361	VARISTOR
D851	TVSEU2AV	DIODE
		CT-9R20TM
D852	RGP10JPKG23	DIODE
		CT-9R20TM
D853	**TVSRD6.2EB1Z**	**DIODE**
		CT-9R20TM
D855	MA165	DIODE
		CT-9R20TM
D856	MA165	DIODE
		CT-9R20TM
D857	RGP10JPKG23	DIODE
		CT-9R20TM
D858	AS01	DIODE
		CT-9R20TM
D860	MA4062M	DIODE, ZENER
		CT-9R20TM
D861	AS01	DIODE
		CT-9R20TM
D862	MA4062L	DIODE, ZENER
		CT-9R20TM
D863	MA165	DIODE
		CT-9R20TM
D864	ERA22-04	DIODE, ZENER
		CT-9R20TM
D865	MA165	DIODE
		CT-9R20TM
D867	MA165	DIODE
		CT-9R20TM
D868	AS01	DIODE
		CT-9R20TM
D869	AS01	DIODE
		CT-9R20TM
		FUSES
F001	**0BA1C40NU100**	**FUSE 4.0A/125V**
		INTEGRATED CIRCUITS
IC001	MN152811HYE	INT CKT
IC002	24C01AIPB21	INT CKT
IC003	MN1280R	INT CKT
IC101	**AN5163K**	**INT CKT**
IC451	LA7835-TV	INT CKT
IC801	TVSSTR30130	INT CKT
IC802	TLP621GR	PHOTO COUPLER
IC851	AN5900	REGULATOR CONTROL
		CT-9R20TM
IC2301	AN5265	INT CKT
		COILS
DEG	TLK269089T	COIL, DEGAUSSING 9"
DY	TLY35303Z	YOKE DEFLECTION
LC301	EIK7EM002Q	DELAY LINE
L005	TLUABTA4R7K	COIL, PEAKING 4.7UH
L014	EXCELSA24	FERRITE BEAD
L101	TLUABTA150K	COIL, PEAKING 15UH
L102	ELESN1R0KA	COIL, PEAKING 1.0UH
L103	EIV7EN041B	COIL, AFT
L105	EIV7EN053B	VCO

REF. NO.	PART NO.	DESCRIPTION
L106	TLQ012K205C	COIL, PEAKING 1.2UH
L107	TLQ012K205C	COIL, PEAKING 1.2UH
L108	TLUABTA1R0K	COIL, PEAKING 1.0UH
L115	EXCELDR25	FERRITE BEAD
L201	EIS7ES004B	COIL, QUADRATURE
L301	TLUABTA220K	PEAKING COIL, 22UH
L351	TLUABTA680K	COIL
		CT-9R10TM CT-9R10CTM
		TP917TM
L352	EXCELSA24	FERRITE BEAD
		CT-9R10TM CT-9R10CTM
		TP917TM
L553	EXCELSA24	FERRITE BEAD
L601	TLUABTA100K	COIL, PEAKING 10UH
L801	ELF18D293M	LINE FILTER
L851	TLT056K109R	COIL, PEAKING 5.6UH
		CT-9R20TM
L853	TSC909	FERRITE BEAD
		CT-9R20TM
L854	TSC909	FERRITE BEAD
		CT-9R20TM
L855	TSC909	FERRITE BEAD
		CT-9R20TM
L856	TSC909	FERRITE BEAD
		CT-9R20TM
L857	TSC909	FERRITE BEAD
		CT-9R20TM
L858	TSC909	FERRITE BEAD
		CT-9R20TM
L860	ELESN151KA	COIL, PEAKING 150UH
		CT-9R20TM
L861	TLP408C	FERRITE BEAD
		CT-9R20TM
		TRANSISTORS
Q003	JC501PQ	TRANSISTOR
Q306	JC501PQ	TRANSISTOR
Q351	2SC1473NC	TRANSISTOR
		CT-9R10TM CT-9R10CTM
		TP917TM
Q352	2SC1473NC	TRANSISTOR
		CT-9R10TM CT-9R10CTM
		TP917TM
Q353	2SC1473NC	TRANSISTOR
		CT-9R10TM CT-9R10CTM
		TP917TM
Q451	JC501PQ	TRANSISTOR
Q452	JC501PQ	TRANSISTOR
Q501	2SC1473AH	TRANSISTOR
Q541	JC501PQ	TRANSISTOR
Q551	**BU2506DF**	**TRANSISTOR**
Q801	2SA1767QTA	TRANSISTOR
Q851	2SC1383NC	TRANSISTOR
		CT-9R20TM
Q852	2SC3300AF	TAPE
		CT-9R20TM
Q854	JC501PQ	TRANSISTOR

REPLACEMENT PARTS LIST

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REF. NO.	PART NO.	DESCRIPTION
		CT-9R20TM
Q855	JA101PQ	TRANSISTOR
		CT-9R20TM
Q860	JA101PQ	TRANSISTOR
		CT-9R20TM
Q861	TVS2P5M	GATED DIODE
		CT-9R20TM
		RELAYS
RL001	TSE1864	RELAY
		RESISTORS
R003	ERJ6GEYJ102	RES,M 1K-J-1/10
R004	ERG1SJ221	RES,M 220-J-1W
R008	ERD25TJ102	RES,C 1K-J-1/4
R010	ERD25TJ101	RES,C 100-J-1/4
R011	ERJ6GEYJ103	RES,M 10K-J-1/10
R018	ERJ6GEYJ472	RES,M 4.7K-J-1/10
R019	ERJ6GEYJ472	RES,M 4.7K-J-1/10
R021	ERJ6GEYJ101	RES,M 100-J-1/10
R022	ERJ6GEYJ101	RES,M 100-J-1/10
R023	ERJ6GEYJ101	RES,M 100-J-1/10
R024	ERJ6GEYJ101	RES,M 100-J-1/10
R025	ERJ6GEYJ101	RES,M 100-J-1/10
R026	ERD25TJ102	RES,C 1K-J-1/4
R030	ERJ6GEYJ683	RES,M 68K-J-1/10
R031	ERJ6GEYJ823	RES,M 82K-J-1/10
R037	ERJ6GEYJ562	RES,M 5.6K-J-1/10
R040	ERJ6GEYJ472	RES,M 4.7K-J-1/10
R041	ERJ6GEYJ472	RES,M 4.7K-J-1/10
R044	ERJ6GEYJ103	RES,M 10K-J-1/10
		CT-9R10CTM
R045	ERJ6GEYJ822	RES,M 8.2K-J-1/10
R050	ERJ6ENF1002	RES,M 10K-F-1/10
R056	ERD25TJ472	RES,C 4.7K-J-1/4
R058	ERJ6GEYJ222	RES,M 2.2K-J-1/10
R059	ERJ6GEYJ222	RES,M 2.2K-J-1/10
R060	ERJ6GEYJ332	RES,M 3.3K-J-1/10
R061	ERJ6GEYJ512	RES,M 5.1K-J-1/10
R062	ERJ6GEYJ912	RES,M 9.1K-J-1/10
R063	ERJ6GEYJ223	RES,M 22K-J-1/10
R065	ERDS2TJ223	RES,C 22K-J-1/4
R066	ERDS2TJ470	RES,C 47-J-1/4
R072	ERJ6GEYJ101	RES,M 100-J-1/10
R074	ERG1ANJ333	RES,M 33K-J-1W
R081	ERJ6GEYJ101	RES,M 100-J-1/10
R083	ERJ6GEYJ101	RES,M 100-J-1/10
R085	ERDS2TJ184	RES,C 180K-J-1/4
R086	ERJ6GEYJ105	RES,M 1.0MEG-J-1/10
R087	ERJ6GEYJ393	RES,M 39K-J-1/10
R089	ERJ6GEYJ822	RES,M 8.2K-J-1/10
R092	ERJ6GEYJ223	RES,M 22K-J-1/10
R102	ERJ6GEYJ393	RES,M 39K-J-1/10
R103	ERJ6GEYJ123	RES,M 12K-J-1/10
R104	ERJ6GEYJ121	RES,M 120-J-1/10
R105	ERJ6GEYJ102	RES,M 1K-J-1/10
R106	EVND2AA03B14	CONTROL 10K
R107	ERD25TJ222	RES,C 2.2K-J-1/4

REF. NO.	PART NO.	DESCRIPTION
R108	ERJ6GEYJ221	RES,M 220-J-1/10
R111	ERJ6GEYJ361	RES,M 360-J-1/10
R112	ERJ6GEYJ561	RES,M 560-J-1/10
R152	ERJ6GEYJ154	RES,M 150K-J-1/10
R201	ERJ6GEYJ221	RES,M 220-J-1/10
R202	ERJ6GEYJ682	RES,M 6.8K-J-1/10
R203	ERJ6GEYJ472	RES,M 4.7K-J-1/10
R206	ERQ1CJP220	RES,F 22-J-1W
R304	ERJ6GEYJ274	RES,M 270K-J-1/10
R305	ERJ6GEYJ102	RES,M 1K-J-1/10
R306	ERJ6GEYJ102	RES,M 1K-J-1/10
R307	ERJ6GEYJ103	RES,M 10K-J-1/10
R308	ERJ6GEYJ822	RES,M 8.2K-J-1/10
R309	ERJ6GEYJ123	RES,M 12K-J-1/10
R317	ERJ6GEYJ132	RES,M 1.3K-J-1/10
R318	ERJ6GEYJ681	RES,M 680-J-1/10
R326	ERJ6GEYJ331	RES,M 330-J-1/10
R339	ERDS2TJ514	RES,C 510K-J-1/4
R347	ERJ6GEYJ822	RES,M 8.2K-J-1/10
		CT-9R10TM CT-9R10CTM
		TP917TM
R348	ERJ6GEYJ822	RES,M 8.2K-J-1/10
		CT-9R10TM CT-9R10CTM
		TP917TM
R349	ERJ6GEYJ822	RES,M 8.2K-J-1/10
		CT-9R10TM CT-9R10CTM
		TP917TM
R351	ERG1ANJ123	RES,M 12K-J-1W
		CT-9R10TM CT-9R10CTM
		TP917TM
R352	ERG1ANJ123	RES,M 12K-J-1W
		CT-9R10TM CT-9R10CTM
		TP917TM
R353	ERG1ANJ123	RES,M 12K-J-1W
		CT-9R10TM CT-9R10CTM
		TP917TM
R354	ERDS1TJ272	RES,C 2.7K-J-1/2
		CT-9R10TM CT-9R10CTM
		TP917TM
R355	ERDS1TJ272	RES,C 2.7K-J-1/2
		CT-9R10TM CT-9R10CTM
		TP917TM
R356	ERDS1TJ272	RES,C 2.7K-J-1/2
		CT-9R10TM CT-9R10CTM
		TP917TM
R357	ERDS2TJ511	RES,C 510-J-1/4
		CT-9R10TM CT-9R10CTM
		TP917TM
R358	ERDS2TJ511	RES,C 510-J-1/4
		CT-9R10TM CT-9R10CTM
		TP917TM
R359	ERDS2TJ511	RES,C 510-J-1/4
		CT-9R10TM CT-9R10CTM
		TP917TM
R364	ERJ6GEYJ151	RES,M 150-J-1/10
		CT-9R10TM CT-9R10CTM

REPLACEMENT PARTS LIST

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REF. NO.	PART NO.	DESCRIPTION
		TP917TM
R365	ERJ6GEYJ151	RES,M 150–J–1/10
		CT–9R10TM CT–9R10CTM
		TP917TM
R366	ERJ6GEYJ151	RES,M 150–J–1/10
		CT–9R10TM CT–9R10CTM
		TP917TM
R401	ERJ6GEYJ224	RES,M 220K–J–1/10
R402	ERJ6GEYJ561	RES,M 560–J–1/10
R404	ERJ6GEYJ221	RES,M 220–J–1/10
R451	ERD25TJ681	RES,C 680–J–1/4
R452	ERJ6GEYJ393	RES,M 39K–J–1/10
R453	TAV1027B503	RES,VARIABLE 50K OHMS
R454	ERDS1FJ1R8	RES,C 1.8–J–1/2
R455	ERJ6GEYJ223	RES,M 22K–J–1/10
R456	ERDS2TJ222	RES,C 2.2K–J–1/4
R457	ERJ6GEYJ102	RES,M 1K–J–1/10
R458	ERJ6GEYJ273	RES,M 27K–J–1/10
R459	ERDS2TJ102	RES,C 1K–J–1/4
R462	ERJ6GEYJ333	RES,M 33K–J–1/10
R463	ERJ6GEYJ684	RES,M 680K–J–1/10
R464	ERD25TJ124	RES,C 120K–J–1/4
R466	ERD25TJ101	RES,C 100–J–1/4
R467	ERD25TJ102	RES,C 1K–J–1/4
R470	ERJ6GEYJ153	RES,M 15K–J–1/10
R472	ERJ6GEYJ103	RES,M 10K–J–1/10
R501	ERJ6GEYJ102	RES,M 1K–J–1/10
R502	ERJ6GEYJ222	RES,M 2.2K–J–1/10
R503	ERJ6GEYJ332	RES,M 3.3K–J–1/10
R504	ERJ6GEYJ821	RES,M 820–J–1/10
R505	ERJ6GEYJ472	RES,M 4.7K–J–1/10
R507	ERJ6GEYJ562	RES,M 5.6K–J–1/10
R509	ERG1ANJ562	RES,M 5.6K–J–1W
R510	ERG5SJ222	RES,M 2.2–J–5W
R515	ERJ6GEYJ682	RES,M 6.8K–J–1/10
R516	ERDS2TJ431	RES,C 430–J–1/4
R517	ERJ6GEYJ274	RES,M 270K–J–1/10
R531	**ERD25FJ2R2**	**RES,C 2.2–J–1/4**
R532	**ERJ6ENF6192**	**RES,M 61.9K–F–1/10**
R533	**ERJ6ENF7151**	**RES,M 7.15K–F–1/10**
R534	**ERJ6GEYJ684**	**RES,M 680K–J–1/10**
R538	**ERDS2TJ821**	**RES,C 820–J–1/4**
R539	**ERJ6GEYJ681**	**RES,M 680–J–1/10**
R541	ERJ6GEYJ332	RES,M 3.3K–J–1/10
R544	ERJ6GEYJ223	RES,M 22K–J–1/10
R547	ERJ6GEYJ103	RES,M 10K–J–1/10
R550	ERDS2TJ823	RES,C 82K–J–1/4
R551	**ERDS1FJ1R0**	**RES,C 1.0–J–1/2**
R552	**ERDS1FJ100**	**RES,C 10–J–1/2**
R553	**ERDS1FJ1R0**	**RES,C 1.0–J–1/2**
R554	ERDS2TJ224	RES,C 220K–J–1/4
		CT–9R20TM
R554	ERDS2TJ244	RES,C 240K–5–1/4
		CT–9R10TM CT–9R10CTM
		TP917TM
R555	ERDS1TJ121	RES,C 120–J–1/2
R556	ERJ6GEYJ472	RES,M 4.7K–J–1/10
R557	ERJ6GEYJ103	RES,M 10K–J–1/10
R558	ERX3SJ6R8	RES,M 6.8–J–3W
		CT–9R10TM CT–9R10CTM
		TP917TM
R559	ERG3ANJ820	RES,M 82–J–3W
R560	ERG2ANJ390	RES,M 39–J–2W
R562	ERG1SJ122	RES,M 1.2K–J–1W
R601	ERJ6GEYJ332	RES,M 3.3K–J–1/10
R602	ERJ6GEYJ103	RES,M 10K–J–1/10
R604	ERJ6GEYJ331	RES,M 330–J–1/10
R605	ERJ6GEYJ331	RES,M 330–J–1/10
R606	ERJ6GEYJ331	RES,M 330–J–1/10
R607	ERJ6GEYJ182	RES,M 1.8K–J–1/10
R608	ERJ6GEYJ182	RES,M 1.8K–J–1/10
R609	ERJ6GEYJ182	RES,M 1.8K–J–1/10
R610	ERJ6GEYJ182	RES,M 1.8K–J–1/10
R611	ERJ6GEYJ681	RES,M 680–J–1/10
R612	ERJ6GEYJ681	RES,M 680–J–1/10
R613	ERJ6GEYJ681	RES,M 680–J–1/10
R614	ERJ6GEYJ222	RES,M 2.2K–J–1/10
R615	ERJ6GEYJ222	RES,M 2.2K–J–1/10
R616	ERJ6GEYJ222	RES,M 2.2K–J–1/10
R617	ERJ6GEYJ222	RES,M 2.2K–J–1/10
R618	ERJ6GEYJ392	RES,M 3.9K–J–1/10
R619	ERJ6GEYJ331	RES,M 330–J–1/10
R801	ERF5ZK5R6	RES,W 5.6–K–5W
R803	ERF10ZJ221	RES,W 220–J–10W
R804	ERD25TJ224	RES,C 220K–J–1/4
R805	ERDS1FJ103	RES,C 10K–J–1/2
R807	ERQ14AJ470	RES,F 47–J–1/4
R808	ERQ14AJ330	RES,F 33–J–1/4
R813	ERDS1FJ2R2	RES,C 2.2–J–1/2
R814	ERDS1FJ2R2	RES,C 2.2–J–1/2
R815	**ERC12ZGK105**	**RES,S 1.0MEG–K–1/2**
		CT–9R10TM TP917TM
R815	**ERC12ZGM825**	**RES,S 8.2MEG–M–1/2**
		CT–9R10CTM CT–9R20TM
R816	ERJ6GEYJ272	RES,M 2.7K–J–1/10
R817	ERDS1TJ333	RES,C 33K–J–1/2
R820	ERJ6GEYJ562	RES,M 5.6K–J–1/10
R822	ERF3AJ180	RES,W 18–J–3W
R851	ERG3SJ330	RES,M 33–J–3W
		CT–9R20TM
R853	ERDS2TJ472	RES,C 4.7K–J–1/4
		CT–9R20TM
R854	**ER0S2CKF1073**	**RES,M 107K–F–1/4**
		CT–9R20TM
R855	**EVN60AA00B52**	**CONTROL 500 OHM**
		CT–9R20TM
R856	**ER0S2CKF4871**	**RES,M 4.87K–F–1/4**
		CT–9R20TM
R857	ERDS2TJ273	RES,C 27K–J–1/4
		CT–9R20TM
R858	ERDS2TJ150	RES,C 15–J–1/4
		CT–9R20TM

REPLACEMENT PARTS LIST

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REF. NO.	PART NO.	DESCRIPTION
R859	ERD25TJ102	RES,C 1K–J–1/4 CT–9R20TM
R860	ERDS2TJ562	RES,C 5.6K–J–1/4 CT–9R20TM
R861	ERDS2TJ103	RES,C 10K–J–1/4 CT–9R20TM
R862	ERDS2TJ272	RES,C 2.7K–J–1/4 CT–9R20TM
R863	ERDS2TJ471	RES,C 470–J–1/4 CT–9R20TM
R864	ERDS2TJ102	RES,C 1K–J–1/4 CT–9R20TM
R865	ERDS1TJ105	RES,C 1MEG–J–1/2 CT–9R20TM
R866	ERDS2TJ332	RES,C 3.3K–J–1/4 CT–9R20TM
R867	ERD25FJ150	RES,C 15–J–1/4 CT–9R20TM
R868	ERDS2TJ821	RES,C 820–J–1/4 CT–9R20TM
R869	ERDS2TJ104	RES,C 100K–J–1/4 CT–9R20TM
R870	ERDS2TJ564	RES,C 560K–J–1/4 CT–9R20TM
R871	ERG1ANJ470	RES,M 47–J–1W CT–9R20TM
R873	ERDS2TJ682	RES,C 6.8K–J–1/4 CT–9R20TM
R874	ERDS2TJ822	RES,C 8.2K–J–1/4 CT–9R20TM
R875	ERDS2TJ123	RES,C 12K–J–1/4 CT–9R20TM
R876	ERDS2TJ273	RES,C 27K–J–1/4 CT–9R20TM
R877	ERDS2TJ123	RES,C 12K–J–1/4 CT–9R20TM
R878	ERDS2TJ682	RES,C 6.8K–J–1/4 CT–9R20TM
R879	ERDS2TJ153	RES,C 15K–J–1/4 CT–9R20TM
R892	ERDS1TJ272	RES,C 2.7K–J–1/2 CT–9R20TM
R2302	ERJ6GEYJ823	RES,M 82K–J–1/10
R2303	ERJ6GEYJ681	RES,M 680–J–1/10
R2304	ERJ6GEYJ822	RES,M 8.2K–J–1/10
R2305	ERJ6GEYJ4R7	RES,M 4.7–J–1/10
R2306	ERJ6GEYJ822	RES,M 8.2K–J–1/10
		SWITCHES
S001	EVQQKH06K	SWITCH
S002	EVQQKH06K	SWITCH
S003	EVQQKH06K	SWITCH
S004	EVQQKH06K	SWITCH
S005	EVQQKH06K	SWITCH
S007	EVQQKH06K	SWITCH
		TRANSFORMERS
T001	TLP16297	TRANSFORMER, POWER SUPPLY
T501	**TLH15412**	**TRANSFORMER, HORIZONTAL DRIVER**
T502	ETE19Z30AY	TRANSFORMER, HORIZONTAL COUPLING
T551	**TLF14774F**	**TRANSFORMER, FLYBACK**
T851	TLP15903	CONVERTER, DRIVE CT–9R20TM
T852	**ETS39K70A**	**TRANSFORMER, DC POWER CT–9R20TM**
		CRYSTALS/FILTERS
X001	EF0EC6004A4	CRYSTAL
X101	EFCH45MVK12N	SAW FILTER
X102	EFCS4R5MW3BA	4.5MHZ TRAP
X201	EFCS4R5MS5W	FILTER 4.5MHZ BANDPASS
X501	EF0A503KS41	CRYSTAL, 503KHZ OSCILLATOR
X601	TS816M32	CRYSTAL 3.58MHZ OSCILLATOR
		OTHERS
RM001	RPM–637CBRS1	RECEIVER, REMOTE CONTROL
TNR001	**ENV568N6G3**	**TUNER**
M001	**A23KQU22X**	**CRT 9"**
M002	EASG7D11A2	SPEAKER, 2–3/4" X 1–1/2" 16 OHM
M003	EUR501332	TRANSMITTER, REMOTE CTRL CT–9R10TM CT–9R10CTM
M004	EUR501333	TRANSMITTER, REMOTE CTRL. CT–9R20TM
M005	EUR501342	TRANSMITTER, REMOTE CTRL. TP917TM
M006	TBL2A3331	SPACER, SWIVEL MTG CT–9R10TM CT–9R10CTM
M007	TBL2A3343	BRKT, SWIVEL ARM SUPPORT CT–9R10TM CT–9R10CTM
M008	TBX2888500	BUTTON, POWER CT–9R10TM CT–9R10CTM TP917TM
M009	TBX2888501	BUTTON, POWER CT–9R20TM
M010	TBX2888600	ASSY, 5 PUSHBUTTON CT–9R10TM CT–9R10CTM TP917TM
M011	TBX2888601	ASSY, 5 PUSHBUTTON CT–9R20TM
M012	TES1208	SPRING, DAG GND ASSY
M013	TES2A10151	SPRING, POWER BUTTON
M014	TJB1726500	BRKT, ANTENNA CT–9R20TM
M015	TJB1726500M	ASSY, ANTENNA 2RF CT–9R20TM
M016	TJB1726600	BRKT, ANTENNA CT–9R10TM TP917TM
M017	TJB2A20801	TERMINAL BD, ANT CT–9R10CTM
M018	TJB2A20801M	TERMINAL BD, ANT CT–9R10CTM
M019	TJC17233	TERMINAL BOARD, A/V CT–9R20TM

REPLACEMENT PARTS LIST

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REF. NO.	PART NO.	DESCRIPTION
M020	TJC17346	ANTENNA, TERM. BOARD CT–9R10CTM CT–9R20TM
M021	TJC2A3021	ANTENNA, TERM. BOARD CT–9R10CTM
M022	**TJS1A5081**	**CRT SOCKET CT–9R10TM CT–9R10CTM TP917TM**
M023	TKP17A3201	PANEL, I/R
M024	TKU420601	COVER, CABT. BACK CT–9R10TM CT–9R10CTM
M025	TKU420602	COVER, CABT. BACK CT–9R20TM
M026	TKU420604	COVER, CABT. BACK TP917TM
M027	TLC2089	MAGNET,RINGS:PURITY & STATIC CONV.
M028	TMM2A30601	WEDGE, YOKE
M029	TQB2A0889	MANUAL, OWNER'S CT–9R10CTM
M030	TQB2A0894	MANUAL, OWNER'S TP917TM
M031	TQB2A0896	MANUAL, OWNER'S CT–9R20TM
M032	TQB2A0914	MANUAL, OWNER'S CT–9R10TM
M033	TQB2A8083	SHT., INFO, LUBE (SWIVEL) CT–9R10TM CT–9R10CTM
M034	TXF3A01APR	ASSY, DAG GND
M035	XBA1F70NU100	FUSE 7.0A/125V CT–9R20TM
M036	0FMK014ZZ	CONVERGENCE CORRECTOR STRIP
M037	0SA100004	ANTENNA, VHF
M038	**0SX110903–1**	**LINE CORD, WHITE CT–9R10TM CT–9R10CTM**
M039	**0SX110905**	**LINE CORD (WHT) TP917TM**
M040	**0SX1118**	**LINE CORD, BLK FLAT (AC) CT–9R20TM**
M041	**0SX13104**	**LINE CORD, DC (BLK) CT–9R20TM**
M042	TXFBL0295SER	ASSY, SWIVEL BOTTOM TP917TM CT–9R10CTM CTIR10TM
M043	TXFKY1095SER	ASSY, CABINET FRONT TP917TM CT–9R10TM
M044	TXFBL0194SER	ASSY, SWIVEL MOUNTING BRACKET CT–9R10CTM
M045	TXFKY3194SER	ASSY, CABINET FRONT CT–9R10TM
M046	TXFKU2595SER	ASSY, CABINET BACK CT–9R10CTM
M047	TXFKY3294SER	ASSY, CABINET FRONT CT–9R10CTM
M048	TXFKY3394SER	ASSY, CABINET FRONT CT–9R20TM CT–9R20T
M049	TXFKU1595SER	ASSY, CABINET BACK CT–9R20T CT–9R20TM
M050	TXFBL0395SER	ASSY, SWIVEL BOTTOM CT–9R20T
J329	EXCELSA24	FERRITE BEAD
M051	UR50EC1136B	BATTERY COVER: TRANSMITTER (WHT) CT–9R10TM CT–9R10CTM TP917TM
M052	UR50EC1136A	BATTERY COVER: TRANSMITTER (BLK) CT–9R20TM
M053	T8A262	SILICONE GREASE – HEAT SINK COMPOUND

DESCRIPTION OF ABBREVIATIONS GUIDE

RESISTOR

TYPE		ALLOWANCE	
C	Carbon	F	+/– 1%
F	Fuse	J	+/– 5%
M	Metal Oxide	K	+/– 10%
S	Solid	M	+/– 20%
W	Wire Wound	G	+/– 2%

RES, C 270–J–1/4

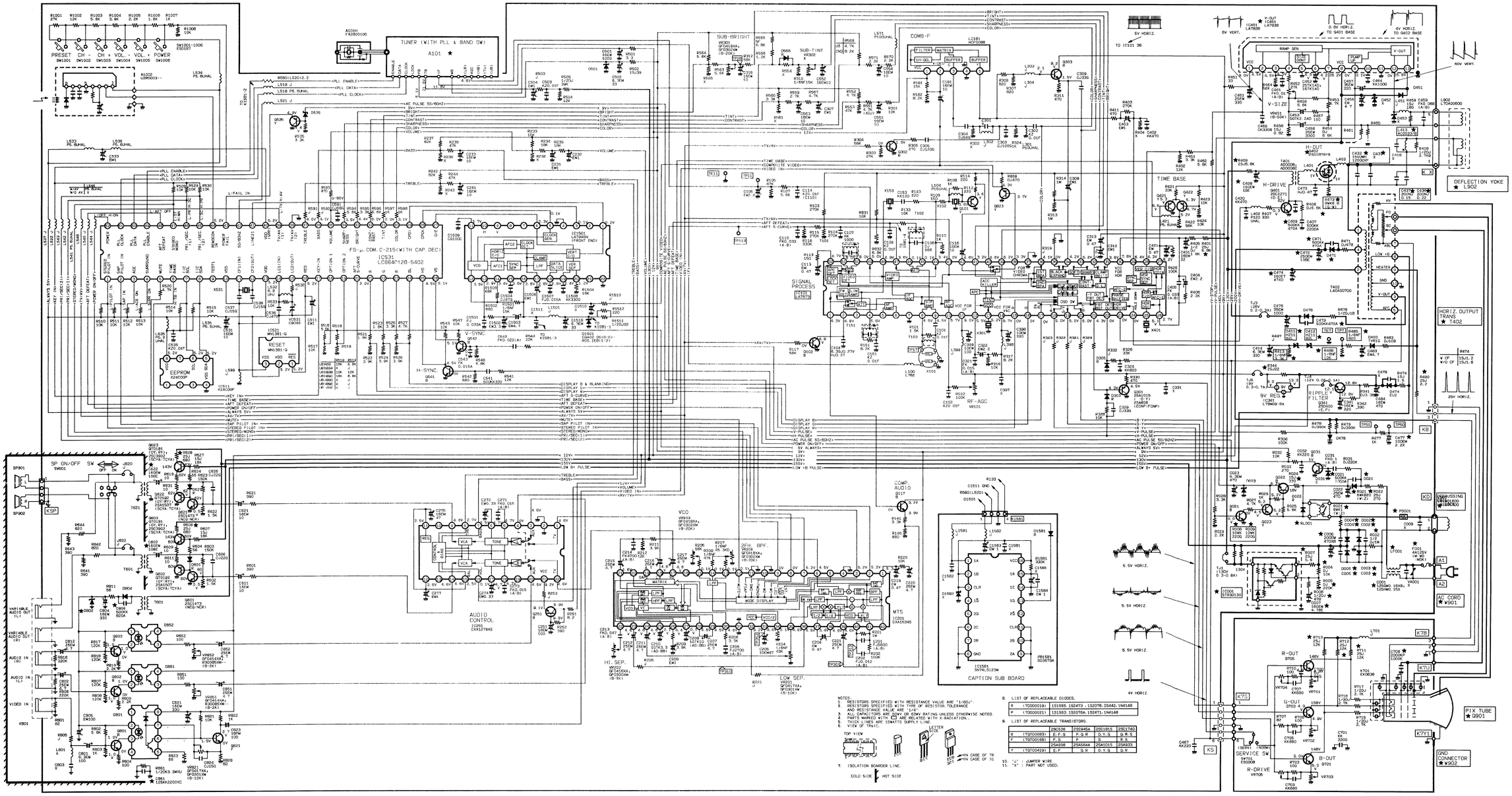
CAPACITOR

TYPE		ALLOWANCE	
C	Ceramic	C	+/– 0.25pF
E	Electrolytic	D	+/– 0.5pF
P	Polyester	F	+/– 1pF
S	Styrol	J	+/– 5%
T	Tantalum	K	+/– 10%
		L	+/– 15%
		M	+/– 20%
		P	+100% –0%
		Z	+80% –20%

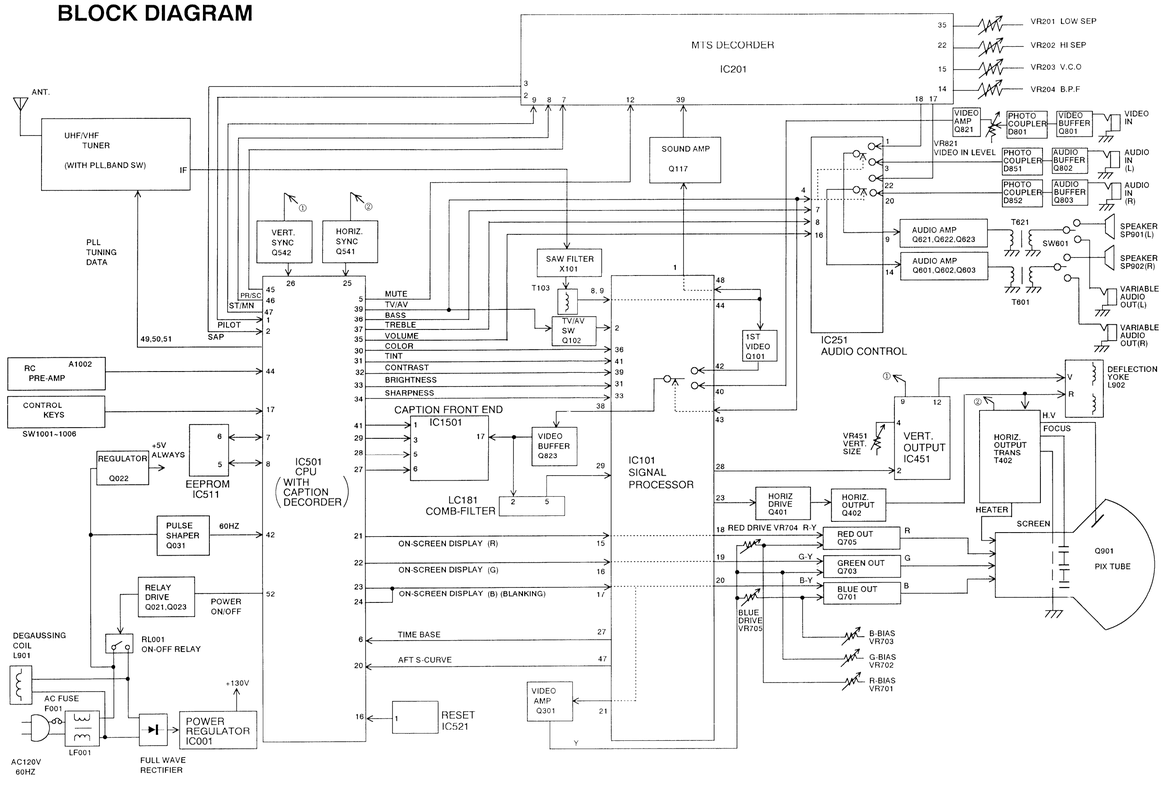
CAP, P .068UF–K–50V

MODEL PC-3527

Chassis No. G3T-35270

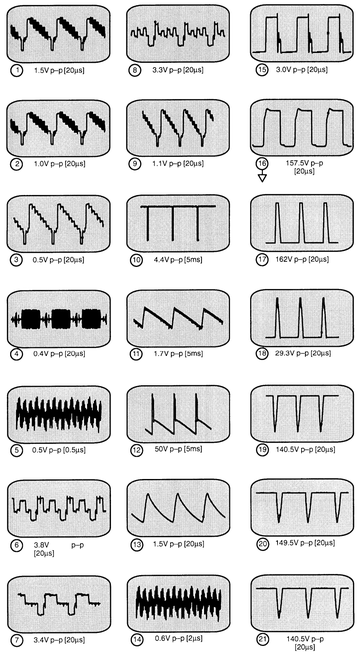


BLOCK DIAGRAM



Waveforms – A–Schematic (All Models)

Waveform #16 is Hot Ground, the others are Cold Ground.



Waveform Measurements

1. ③ indicates waveform measurement. (Measurement can be taken at best accessible location in common to indicated point.)
2. Taken with a NTSC signal generator connected to antenna terminal. (NTSC color bar pattern of 8 bars of EIA colors, 100 IRE white and 7.5 IRE black)
3. Customer Controls (Picture/Audio Menu) are set to Normalize. Volume "MIN".
4. All video and color waveforms taken with a wideband scope and a probe with low capacity (10 to 1). Shape and peak amplitudes may vary depending on type of Oscilloscope used and calibration.
5. Ground symbol ⏚ shown on waveform number indicates (Hot) ground lead connection of Oscilloscope.
   CAUTION: Incorrect ground connection of test equipment will result in erroneous readings.

These waveforms have been taken in the order of circuit flow through the various sections as follows:

VIDEO – Waveforms 1–3
COLOR – Waveforms 4–8
VERTICAL – Waveforms 9–12
HORIZONTAL – Waveforms 13–16
CRT DRIVE – Waveforms 17 & 18
POWER SUPPLY – Waveform 19 ~ 21

Schematic Notes

1. Resistors are carbon 1/4W unless noted otherwise.
2. Capacitors are ceramic 50V unless noted otherwise.
3. Coil value noted is inductance in µH.
4. Test point indicated by ●, Test point but no pin ○.
5. Components indicated with ⚠ symbol are critical parts and replacement should be made with manufacture specified replacement parts only.
6. **— (BOLD LINES)** Indicates the route of B+ supply.
7. This schematic diagram is the latest at the time of printing and subject to change without notice.
8. Ground symbol ⏚ indicates **HOT GROUND CONNECTION** and ⏥ indicates COLD GROUND CONNECTION.

   NOTE: All other component symbols are used for design engineering purposes.

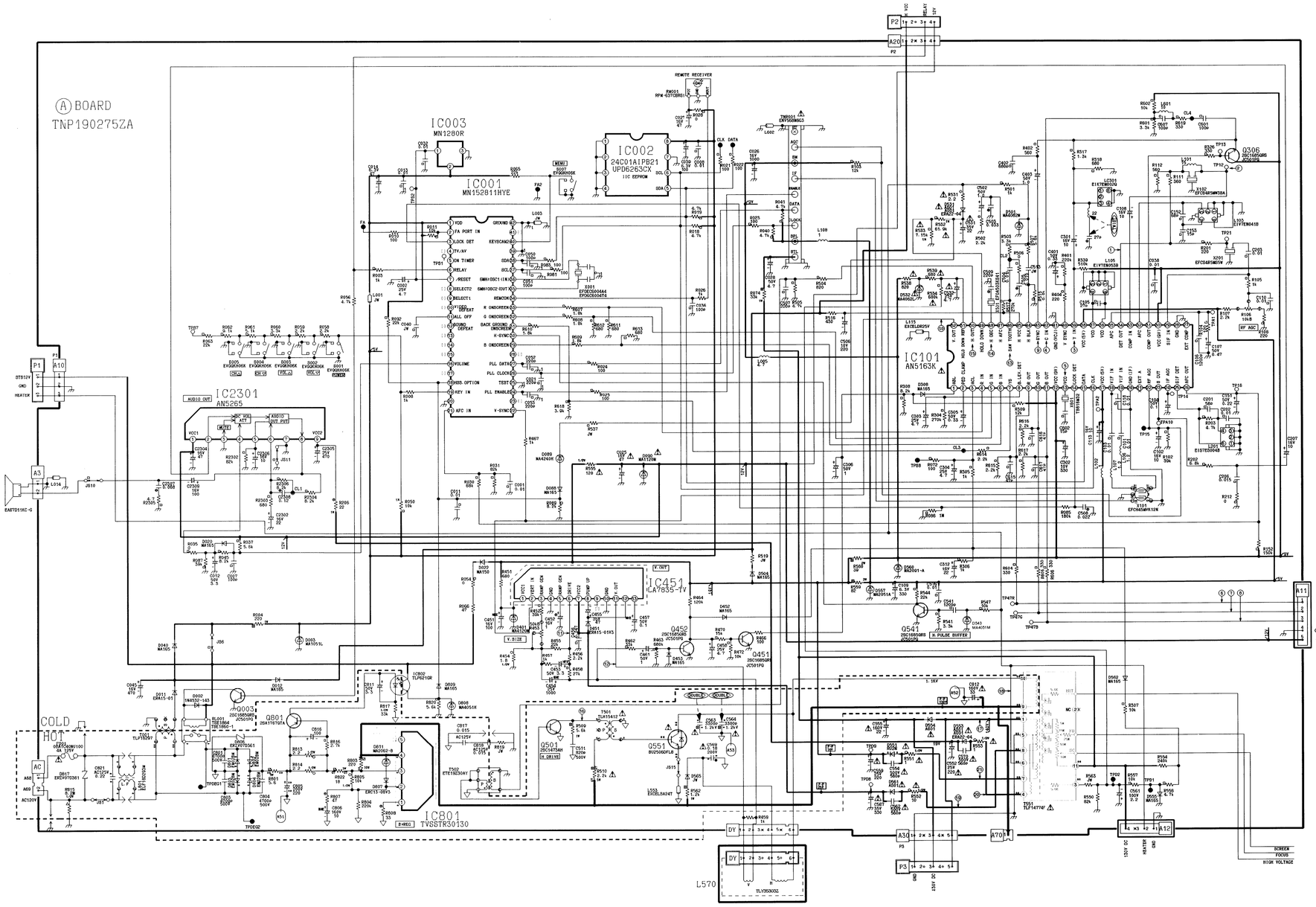
Voltage Measurements

1. Voltage measurement:
   – AC input to Receiver is 120V. NTSC generator connected to antenna of Receiver. (color bar pattern of 100IRE white and 7.5 IRE black.)
   – All Picture and Audio adjustments set for Normalize.
   TV ANT/CABLE – (Set–Up Menu) in TV/ANT Mode
   Volume – Min
   TV/Video SW – TV position
   Audio Mode – Stereo
   – Voltage readings are nominal and may vary ±10% on active devices.
   Some voltage reading will vary with signal strength and picture content.
   – Supply voltages are all nominal.
2. Ground symbol ⏚ indicates ground lead connection of meter. **Caution: Incorrect ground connection will result in erroneous readings.**

The Functions listed below are activated by a DC voltage change to DAC Inputs (Pin 19 and 40) of MPU IC001. Press and hold a function button on Receiver to take voltage readings.

FUNCTION	PIN 19	PIN 40
POWER	0V~0.4V	
VOL ▼	0.5V~1.1V	
VOL ▲	1.2V~1.7V	
CH ▼	1.8V~2.3V	
CH ▲	2.4V~3.9V	
ACTION		0V~1.5V

A–Board Schematic (CT–9R20T)



Voltage Chart – A–Board

Integrated Circuits (ICs)

IC001		IC001				IC002		IC101						IC451		IC2301		IC802	
1	5.2	19	5.1	37	3.7	1	0	1	2.5	19	3.0	37	3.0	1	12.1	1	12.1	⏚ A	0
2	5.3	20	0	38	4.2	2	0	2	1.7	20	0	38	5.0	2	5.4	2	5.4	⏚ K	–.1
3	4.9	21	2.3	39	0	3	0	3	3.3	21	4.1	39	3.9	3	6.2	3	0	E	0
4	0	22	4.1	40	5.1	4	0	4	0	22	5.1	40	2.6	4	0	4	0.2	C	11.9
5	0	23	0.1	41	0.2	5	4.2	5	0	23	4.5	41	0	5	6.1	5	7.9		
6	5.1	24	0.1	42	0	6	3.7	6	0	24	2.7	42	5.9	6	6.0	6	8.1		
7	5.0	25	0			7	0	7	0	25	4.6	43	2.0	7	25.5	7	0		
8	0.1	26	0.1			8	5.1	8	5.8	26	3.4	44	0.7	8	1.5	8	8.3		
9	0.1	27	0.1					9	2.4	27	2.7	45	6.2	9	1.1	9	17.3		
10	0.1	28	0			IC003		10	2.7	28	0	46	2.6	10	0			IC801⏚	
11	0.1	29	0			1	5.2	11	2.5	29	2.7	47	4.2	11	13.9			1	0.2
12	0	30	4.2			2	5.2	12	9.1	30	9.1	48	2.1	12	25.9			2	130.8
13	0.1	31	0			3	0	13	2.6	31	5.2	49	2.4	13	5.1			3	150.0
14	0.1	32	0					14	5.8	32	2.9	50	0.8					4	130.0
15	0.1	33	0					15	4.2	33	2.7	51	5.8					5	NC
16	0.1	34	5.1					16	3.8	34	2.8	52	4.1						
17	0	35	2.0					17	5.0	35	1.6								
18	1.4	36	2.1					18	3.0	36	3.0								

Transistors

Ref.	b	c	e
Q003	0.7	0	0
Q306	5.2	9.1	4.5
Q451	0	2.7	0
Q452	6.1	1.4	0
⏚ Q501	0	88.7	0
⏚ Q541	0	4.7	0
⏚ Q551	0	135.8	0
⏚ Q801	154	0.2	153

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MICROPROCESSOR PROGRAMMING FOR BAND TUNING/SWITCHING

	54MHz ◄► 130MHz FIRST TUNING BAND	130MHz ◄► 360MHz SECOND TUNING BAND	360MHz ◄► 806MHz THIRD TUNING BAND
VHF	02–06	07–13	
UHF			14–69
CABLE	01–06,14,15,95–99	07–13,16–46	47–94,100–125

NOTE: CABLE channel numbers as recommended by the joint EIA/NCTA Engineering Committee and published as EIA INTERIM STANDARD NO. 6 – CABLE TELEVISION CHANNEL IDENTIFICATION PLAN – MAY 1983.

Circuit Board Function Index

CIRCUIT BOARDS	FUNCTION
A–BOARD	MAIN
C–BOARD	CRT
P–BOARD (CT–9R20T)	DC POWER SUPPLY and DEGAUSSING CIRCUIT.

Tuner Voltage Chart

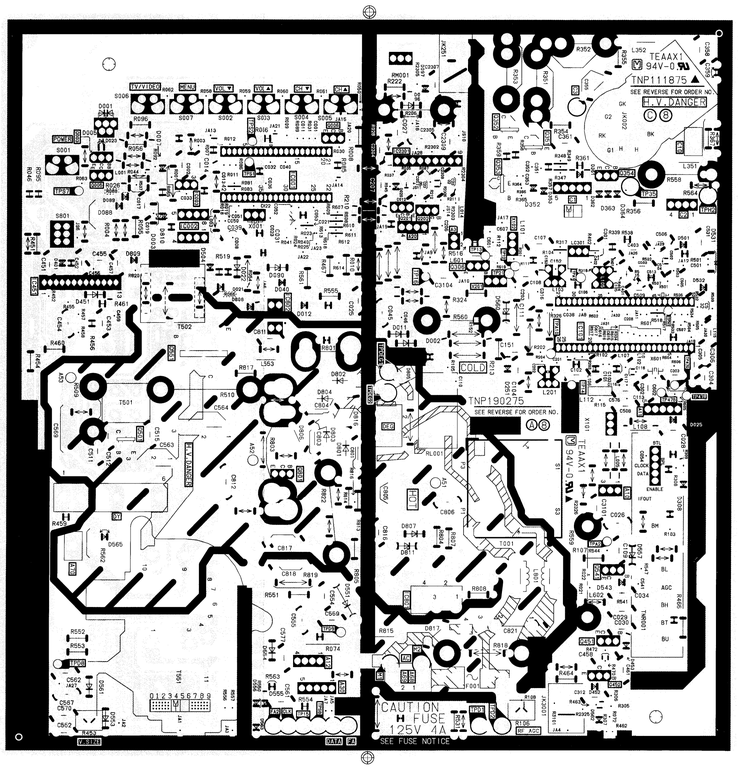
Enable, Data, and Clock have no DC readings. They are digital signals from the MPU.
NOTE: Voltage at the BTL test pin varies with channel selection. Refer to chart for sample tuning voltages of TV/CATV(CABLE) channels as shown.

Voltage Reading Are Nominal And May Vary ± 15%

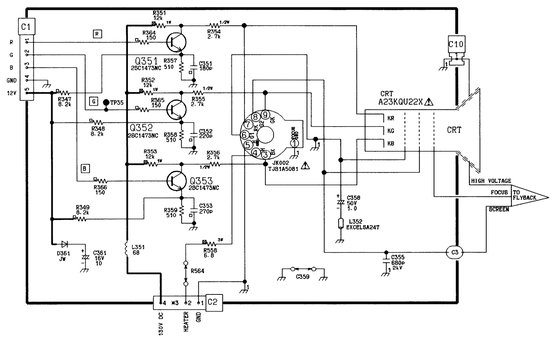
– VHF –	
Ch. 02	5.1V
Ch. 06	9.9V
Ch. 07	8.5V
Ch. 13	10.7V

– UHF –	
Ch. 14	9.1V
Ch. 69	27.1V

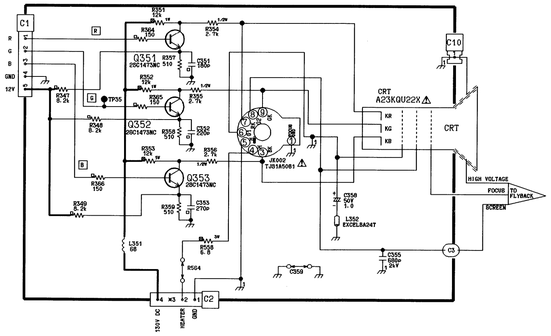
– CABLE –					
1st Band		2nd Band		3rd Band	
Ch. 1	8.0V	Ch. 16	5.5V	Ch. 47	4.9V
Ch. 15	22.0V	Ch. 46	26.4V	Ch. 94	16.9V
Ch. 95	10.6V			Ch. 100	17.1V
Ch. 99	16.0V			Ch. 125	27.1V



TNP111875AA
C–Board Schematic (CT–9R20T)



TNP111875ZA
C–Board Schematic (CT–9R10T; CT–9R10CT; & TP917T)



Voltage Chart – C–Board (All Models)

Transistors

Ref.	b	c	e
Q351	2.8	96.4	2.4
Q352	2.9	94.2	2.5
Q353	2.9	95.2	2.4

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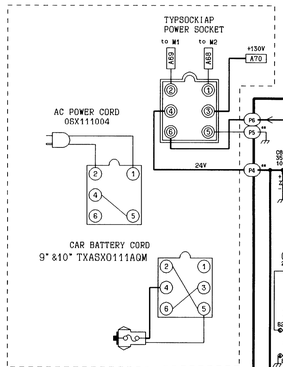
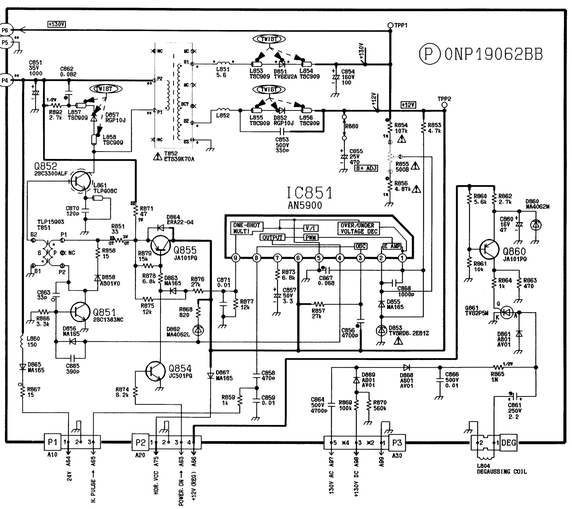
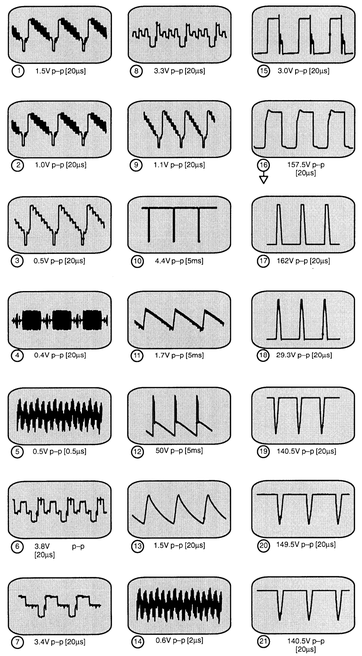


P–Board Schematic (CT–9R20T)



Waveforms – A–Schematic (All Models)

Waveform #16 is Hot Ground, the others are Cold Ground.



Waveform Measurements

1. ③ indicates waveform measurement. (Measurement can be taken at best accessible location in common to indicated point.)
2. Taken with a NTSC signal generator connected to antenna terminal. (NTSC color bar pattern of 8 bars of EIA colors, 100 IRE white and 7.5 IRE black)
3. Customer Controls (Picture/Audio Menu) are set to Normalize. Volume "MIN".
4. All video and color waveforms taken with a wideband scope and a probe with low capacity (10 to 1). Shape and peak amplitudes may vary depending on type of Oscilloscope used and calibration.
5. Ground symbol ⏚ shown on waveform number indicates (Hot) ground lead connection of Oscilloscope.

   CAUTION: Incorrect ground connection of test equipment will result in erroneous readings.

These waveforms have been taken in the order of circuit flow through the various sections as follows:

VIDEO – Waveforms 1–3
COLOR – Waveforms 4–8
VERTICAL – Waveforms 9–12
HORIZONTAL – Waveforms 13–16
CRT DRIVE – Waveforms 17 & 18
POWER SUPPLY – Waveform 19 ~ 21

Schematic Notes

1. Resistors are carbon 1/4W unless noted otherwise.
2. Capacitors are ceramic 50V unless noted otherwise.
3. Coil value noted is inductance in µH.
4. Test point indicated by ▮, Test point but no pin ⚲.
5. Components indicated with ⚠ symbol are critical parts and replacement should be made with manufacture specified replacement parts only.
6. **— (BOLD LINES)** Indicates the route of B+ supply.
7. This schematic diagram is the latest at the time of printing and subject to change without notice.
8. Ground symbol ⏚ indicates **HOT GROUND CONNECTION** and ⏥ indicates COLD GROUND CONNECTION.

   NOTE: All other component symbols are used for design engineering purposes.

Voltage Measurements

1. Voltage measurement:
   – AC input to Receiver is 120V. NTSC generator connected to antenna of Receiver. (color bar pattern of 100IRE white and 7.5 IRE black.)
   – All Picture and Audio adjustments set for Normalize.
   TV ANT/CABLE – (Set–Up Menu) in TV/ANT Mode
   Volume – Min
   TV/Video SW – TV position
   Audio Mode – Stereo
   – Voltage readings are nominal and may vary ±10% on active devices.
   Some voltage reading will vary with signal strength and picture content.
   – Supply voltages are all nominal.
2. Ground symbol ⏚ indicates ground lead connection of meter. **Caution: Incorrect ground connection will result in erroneous readings.**

The Functions listed below are activated by a DC voltage change to DAC Inputs (Pin 19 and 40) of MPU IC001. Press and hold a function button on Receiver to take voltage readings.

FUNCTION	PIN 19	PIN 40
POWER	0V~0.4V	
VOL ▼	0.5V~1.1V	
VOL ▲	1.2V~1.7V	
CH ▼	1.8V~2.3V	
CH ▲	2.4V~3.9V	
ACTION		0V~1.5V

Voltage Chart – A–Board

Integrated Circuits (ICs)

IC001		IC001			
1	5.2	19	5.1	37	3.7
2	5.3	20	0	38	4.2
3	4.9	21	2.3	39	0
4	0	22	4.1	40	5.1
5	0	23	0.1	41	0.2
6	5.1	24	0.1	42	0
7	5.0	25	0		
8	0.1	26	0.1		
9	0.1	27	0.1		
10	0.1	28	0		
11	0.1	29	0		
12	0	30	4.2		
13	0.1	31	0		
14	0.1	32	0		
15	0.1	33	0		
16	0.1	34	5.1		
17	0	35	2.0		
18	1.4	36	2.1		

IC002	
1	0
2	0
3	0
4	0
5	4.2
6	3.7
7	0
8	5.1

IC003	
1	5.2
2	5.2
3	0

IC101		IC101			
1	2.5	19	3.0	37	3.0
2	1.7	20	0	38	5.0
3	3.3	21	4.1	39	3.9
4	0	22	5.1	40	2.6
5	0	23	4.5	41	0
6	0	24	2.7	42	5.9
7	0	25	4.6	43	2.0
8	5.8	26	3.4	44	0.7
9	2.4	27	2.7	45	6.2
10	2.7	28	0	46	2.6
11	2.5	29	2.7	47	4.2
12	9.1	30	9.1	48	2.1
13	2.6	31	5.2	49	2.4
14	5.8	32	2.9	50	0.8
15	4.2	33	2.7	51	5.8
16	3.8	34	2.8	52	4.1
17	5.0	35	1.6		
18	3.0	36	3.0		

IC451	
1	12.1
2	4.1
3	6.2
4	0
5	6.1
6	6.0
7	25.5
8	1.5
9	1.1
10	0
11	13.9
12	25.9
13	5.1

IC2301	
1	12.1
2	5.4
3	0
4	0.2
5	7.9
6	8.1
7	0
8	8.3
9	17.3

IC802	
⏚ A	0
⏚ K	–.1
E	0
C	11.9

IC801 ⏚	
1	0.2
2	130.8
3	150.0
4	130.0
5	NC

Transistors

Ref.	b	c	e
Q003	0.7	0	0
Q306	5.2	9.1	4.5
Q451	0	2.7	0
Q452	6.1	1.4	0
⏚ Q501	0	88.7	0
⏚ Q541	0	4.7	0
⏚ Q551	0	135.8	0
⏚ Q801	154	0.2	153

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MICROPROCESSOR PROGRAMMING FOR BAND TUNING/SWITCHING

	54MHz ◄► 130MHz	130MHz ◄► 360MHz	360MHz ◄► 806MHz
	FIRST TUNING BAND	SECOND TUNING BAND	THIRD TUNING BAND
VHF	02–06	07–13	
UHF			14–69
CABLE	01–06,14,15,95–99	07–13,16–46	47–94,100–125

NOTE: CABLE channel numbers as recommended by the joint EIA/NCTA Engineering Committee and published as EIA INTERIM STANDARD NO. 6 – CABLE TELEVISION CHANNEL IDENTIFICATION PLAN – MAY 1983.

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Enable, Data, and Clcck have no DC readings. They are digital signals from the MPU.

NOTE: Voltage at the BTL test pin varies with channel selection. Refer to chart for sample tuning voltages of TV/CATV(CABLE) channels as shown.

Voltage Reading Are Nominal And May Vary ± 15%

– VHF –	
Ch. 02	5.1V
Ch. 06	9.9V
Ch. 07	8.5V
Ch. 13	10.7V

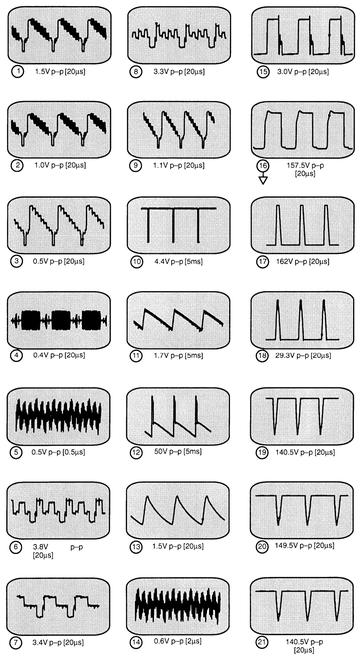
– UHF –	
Ch. 14	9.1V
Ch. 69	27.1V

– CABLE –					
1st Band		2nd Band		3rd Band	
Ch. 1	8.0V	Ch. 16	5.5V	Ch. 47	4.9V
Ch. 15	22.0V	Ch. 46	26.4V	Ch. 94	16.9V
Ch. 95	10.6V			Ch. 100	17.1V
Ch. 99	16.0V			Ch. 125	27.1V

A–Board Schematic (CT–9R10CT)

Waveforms – A–Schematic (All Models)

Waveform #16 is Hot Ground, the others are Cold Ground.



Waveform Measurements

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2. Taken with a NTSC signal generator connected to antenna terminal. (NTSC color bar pattern of 8 bars of EIA colors, 100 IRE white and 7.5 IRE black)
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VIDEO – Waveforms 1–3
COLOR – Waveforms 4–8
VERTICAL – Waveforms 9–12
HORIZONTAL – Waveforms 13–16
CRT DRIVE – Waveforms 17 & 18
POWER SUPPLY – Waveform 19 – 21

Schematic Notes

1. Resistors are carbon 1/4W unless noted otherwise.
2. Capacitors are ceramic 50V unless noted otherwise.
3. Coil value noted is inductance in µH.
4. Test point indicated by ●, Test point but no pin ○.
5. Components indicated with ⚠ symbol are critical parts and replacement should be made with manufacture specified replacement parts only.
6. ▬ **(BOLD LINES)** Indicates the route of B+ supply.
7. This schematic diagram is the latest at the time of printing and subject to change without notice.
8. Ground symbol ⏚ indicates **HOT GROUND CONNECTION** and ⏚ indicates COLD GROUND CONNECTION.

   NOTE: All other component symbols are used for design engineering purposes.

Voltage Measurements

1. Voltage measurement:
   – AC input to Receiver is 120V. NTSC generator connected to antenna of Receiver. (color bar pattern of 100IRE white and 7.5 IRE black.)
   – All Picture and Audio adjustments set for Normalize.
   TV ANT/CABLE – (Set–Up Menu) in TV/ANT Mode
   Volume – Min
   TV/Video SW – TV position
   Audio Mode – Stereo
   – Voltage readings are nominal and may vary ±10% on active devices.
   Some voltage reading will vary with signal strength and picture content.
   – Supply voltages are all nominal.
2. Ground symbol ⏚ indicates ground lead connection of meter. **Caution: Incorrect ground connection will result in erroneous readings.**

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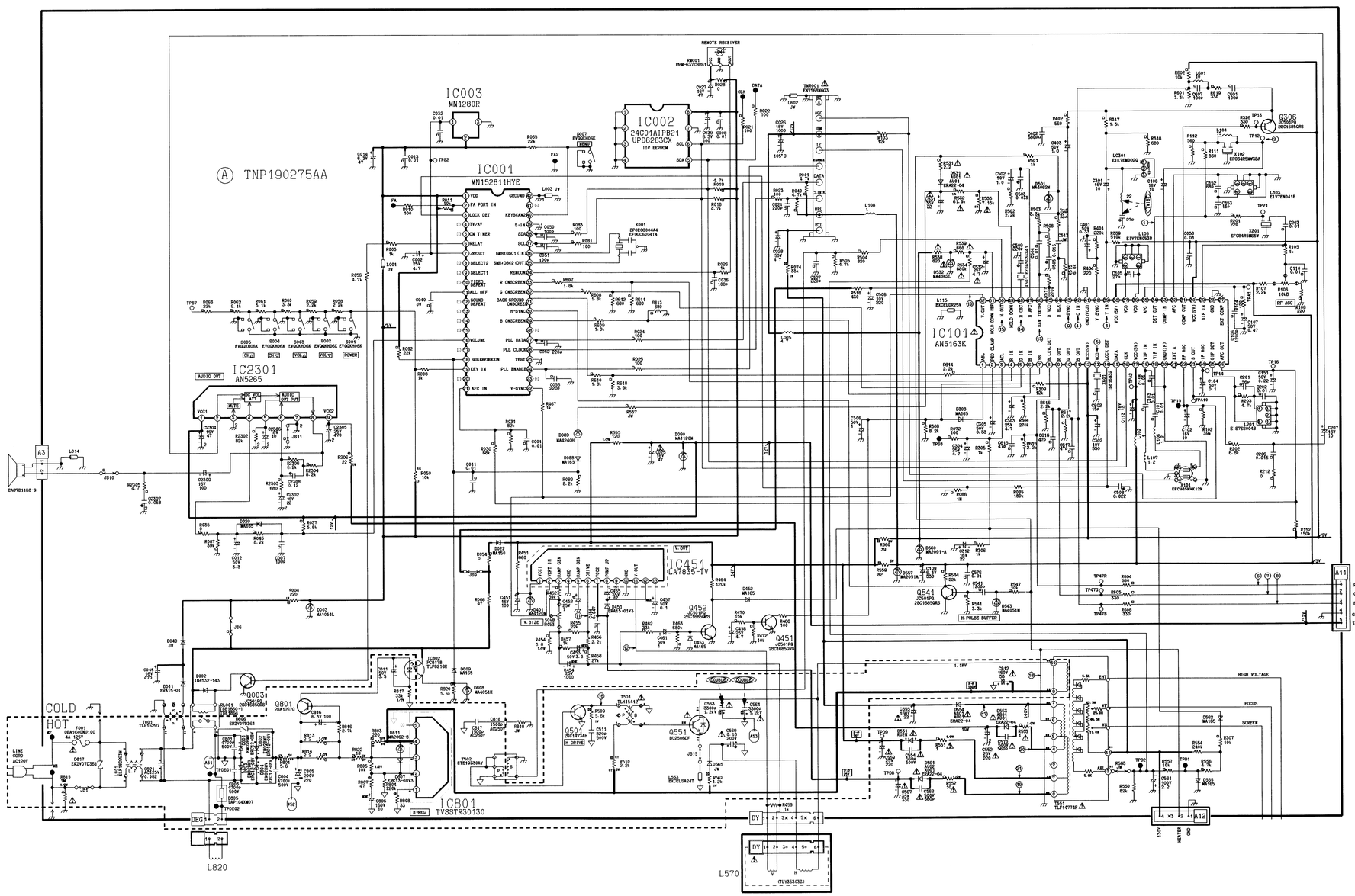
FUNCTION	PIN 19	PIN 40
POWER	0V–0.4V	
VOL▼	0.5V–1.1V	
VOL▲	1.2V–1.7V	
CH▼	1.8V–2.3V	
CH▲	2.4V–3.9V	
ACTION		0V–1.5V



Voltage Chart – A–Board

Integrated Circuits (ICs)

IC001		IC001			IC002		IC101				IC451		IC2301		IC802	
1	5.2	19	5.1	37	3.7	1	0	1	2.5	19	3.0	37	3.0	1	12.1	1	12.1	⏚ A	0
2	5.3	20	0	38	4.2	2	0	2	1.7	20	0	38	5.0	2	4.1	2	5.4	⏚ K	⌐.1
3	4.9	21	2.3	39	0	3	0	3	3.3	21	4.1	39	3.9	3	6.2	3	0	E	0
4	0	22	4.1	40	5.1	4	0	4	0	22	5.1	40	2.6	4	0	4	0.2	C	11.9
5	0	23	0.1	41	0.2	5	4.2	5	0	23	4.5	41	0	5	6.1	5	7.9		
6	5.1	24	0.1	42	0	6	3.7	6	0	24	2.7	42	5.9	6	6.0	6	8.1		
7	5.0	25	0			7	0	7	0	25	4.6	43	2.0	7	25.5	7	0		
8	0.1	26	0.1			8	5.1	8	5.8	26	3.4	44	0.7	8	1.5	8	8.3		
9	0.1	27	0.1					9	2.4	27	2.7	45	6.2	9	1.1	9	17.3		
10	0.1	28	0			IC003		10	2.7	28	0	46	2.6	10	0				
11	0.1	29	0			1	5.2	11	2.5	29	2.7	47	4.2	11	13.9	IC801⏚			
12	0	30	4.2			2	5.2	12	9.1	30	9.1	48	2.1	12	25.9	1	0.2		
13	0.1	31	0			3	0	13	2.6	31	5.2	49	2.4	13	5.1	2	130.8		
14	0.1	32	0					14	5.8	32	2.9	50	0.8			3	150.0		
15	0.1	33	0					15	4.2	33	2.7	51	5.8			4	130.0		
16	0.1	34	5.1					16	3.8	34	2.8	52	4.1			5	NC		
17	0	35	2.0					17	5.0	35	1.6								
18	1.4	36	2.1					18	3.0	36	3.0								

Transistors

Ref.	b	c	e
Q003	0.7	0	0
Q306	5.2	9.1	4.5
Q451	0	2.7	0
Q452	6.1	1.4	0
⏚ Q501	0	88.7	0
⏚ Q541	0	4.7	0
⏚ Q551	0	135.8	0
⏚ Q801	154	0.2	153

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MICROPROCESSOR PROGRAMMING FOR BAND TUNING/SWITCHING

	54MHz ◄► 130MHz	130MHz ◄► 360MHz	360MHz ◄► 806MHz
	FIRST TUNING BAND	SECOND TUNING BAND	THIRD TUNING BAND
VHF	02–06	07–13	
UHF			14–69
CABLE	01–06,14,15,95–99	07–13,16–46	47–94,100–125

NOTE: CABLE channel numbers as recommended by the joint EIA/NCTA Engineering Committee and published as EIA INTERIM STANDARD NO. 6 – CABLE TELEVISION CHANNEL IDENTIFICATION PLAN – MAY 1983.

Circuit Board Function Index

CIRCUIT BOARDS	FUNCTION
A–BOARD	MAIN
C–BOARD	CRT
P–BOARD (CT–9R20T)	DC POWER SUPPLY and DEGAUSSING CIRCUIT.

Tuner Voltage Chart

Enable, Data, and Clock have no DC readings. They are digital signals from the MPU.

NOTE: Voltage at the BTL test pin varies with channel selection. Refer to chart for sample tuning voltages of TV/CATV(CABLE) channels as shown.

Voltage Reading Are Nominal And May Vary ± 15%

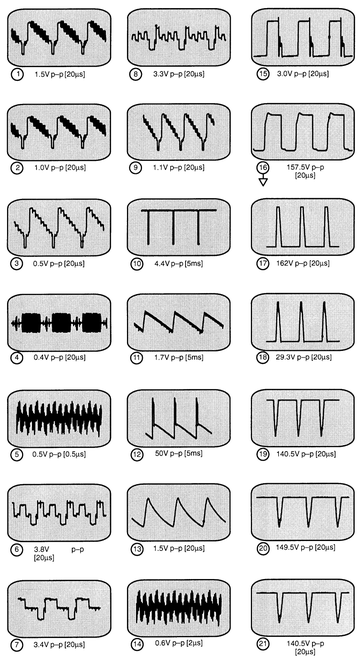
– VHF –	
Ch. 02	5.1V
Ch. 06	9.9V
Ch. 07	8.5V
Ch. 13	10.7V

– UHF –	
Ch. 14	9.1V
Ch. 69	27.1V

– CABLE –					
1st Band		2nd Band		3rd Band	
Ch. 1	8.0V	Ch. 16	5.5V	Ch. 47	4.9V
Ch. 15	22.0V	Ch. 46	26.4V	Ch. 94	16.9V
Ch. 95	10.6V			Ch. 100	17.1V
Ch. 99	16.0V			Ch. 125	27.1V

Waveforms – A–Schematic (All Models)

Waveform #16 is Hot Ground, the others are Cold Ground.



Waveform Measurements

1. (3) indicates waveform measurement. (Measurement can be taken at best accessible location in common to indicated point.)
2. Taken with a NTSC signal generator connected to antenna terminal. (NTSC color bar pattern of 8 bars of EIA colors, 100 IRE white and 7.5 IRE black)
3. Customer Controls (Picture/Audio Menu) are set to Normalize. Volume "MIN".
4. All video and color waveforms taken with a wideband scope and a probe with low capacity (10 to 1). Shape and peak amplitudes may vary depending on type of Oscilloscope used and calibration.
5. Ground symbol ⏚ shown on waveform number indicates (Hot) ground lead connection of Oscilloscope.
   CAUTION: Incorrect ground connection of test equipment will result in erroneous readings.

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VIDEO – Waveforms 1~3
COLOR – Waveforms 4~8
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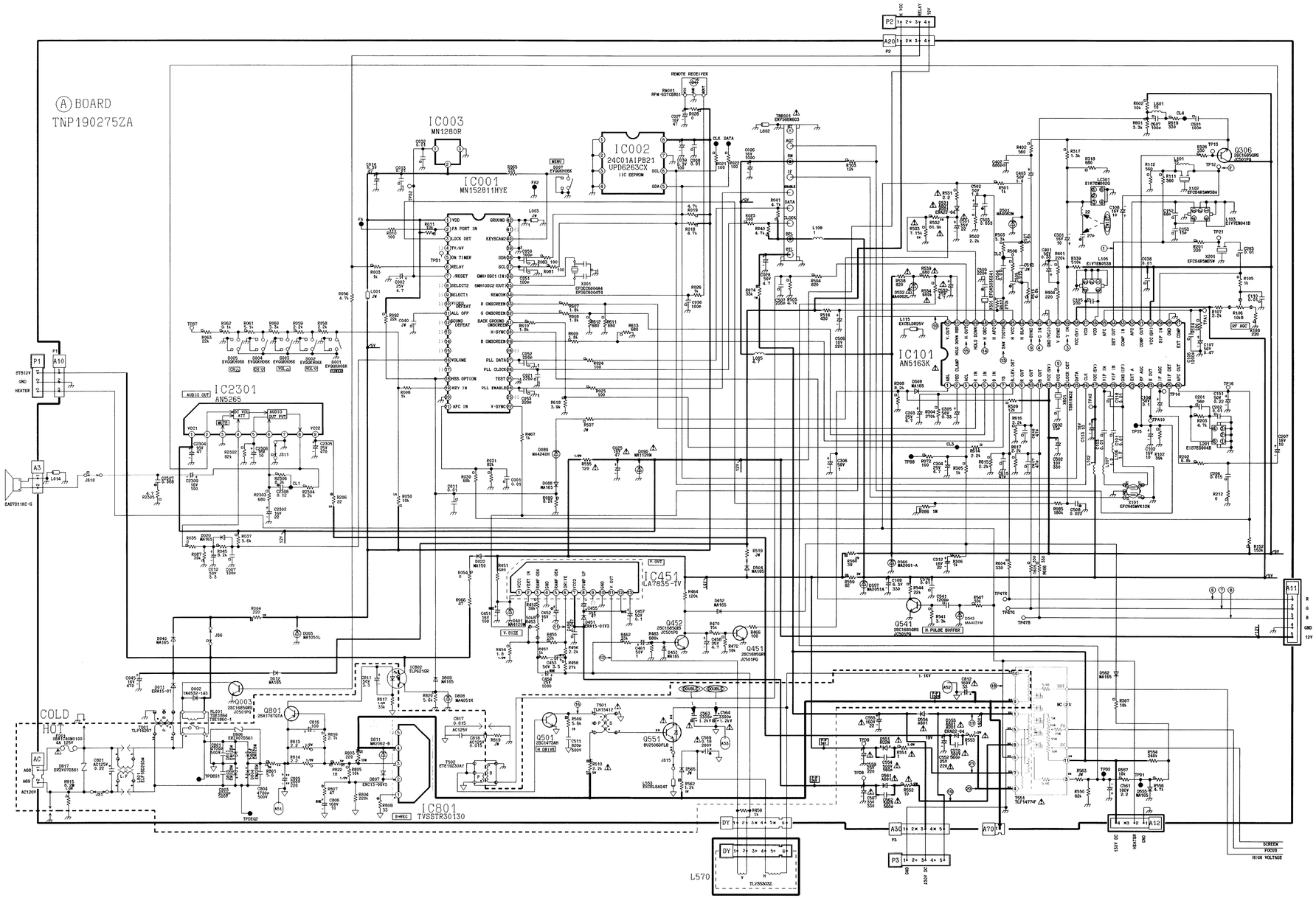
POWER	0V~0.4V	
VOL▼	0.5V~1.1V	
VOL▲	1.2V~1.7V	
CH▼	1.8V~2.3V	
CH▲	2.4V~3.9V	
ACTION		0V~1.5V

A–Board Schematic (CT–9R20T)



Voltage Chart – A–Board

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2	5.3	20	0	38	4.2	2	0	2	1.7	20	0	38	5.0	2	4.1	2	5.4	⏚	K –.1
3	4.9	21	2.3	39	0	3	0	3	3.3	21	4.1	39	3.9	3	6.2	3	0		E 0
4	0	22	4.1	40	5.1	4	0	4	0	22	5.1	40	2.6	4	0	4	0.2		C 11.9
5	0	23	0.1	41	0.2	5	4.2	5	0	23	4.5	41	0	5	6.1	5	7.9		
6	5.1	24	0.1	42	0	6	3.7	6	0	24	2.7	42	5.9	6	6.0	6	8.1		
7	5.0	25	0			7	0	7	0	25	4.6	43	2.0	7	25.5	7	0		
8	0.1	26	0.1			8	5.1	8	5.8	26	3.4	44	0.7	8	1.5	8	8.3		
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Ch. 95	10.6V			Ch. 100	17.1V
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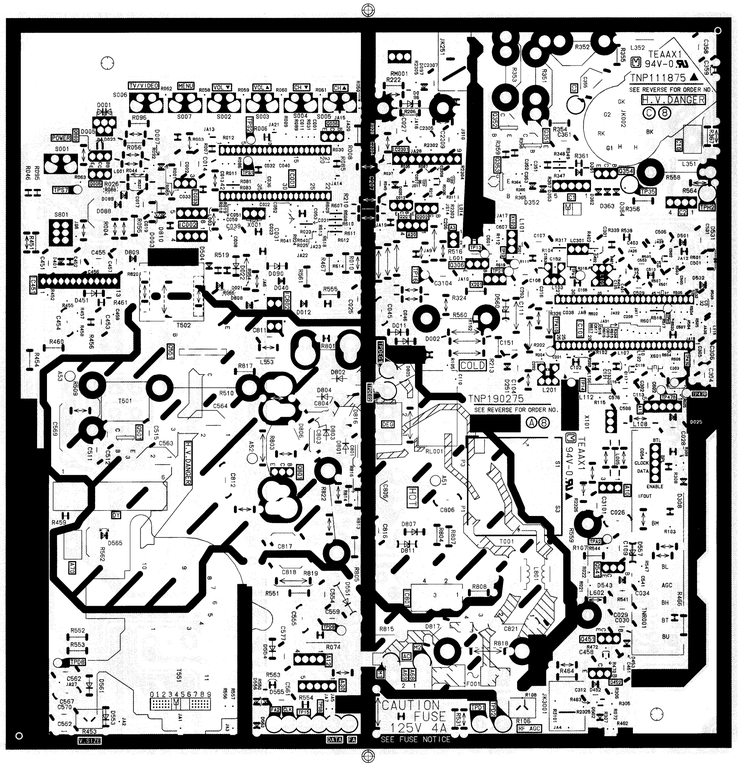
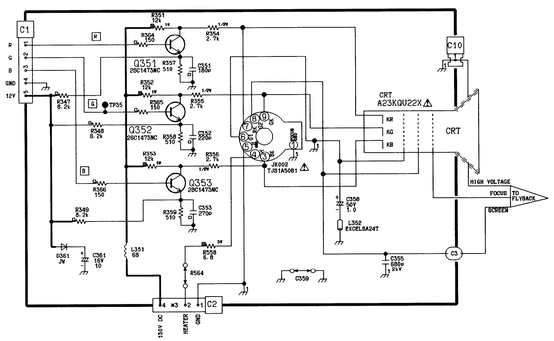
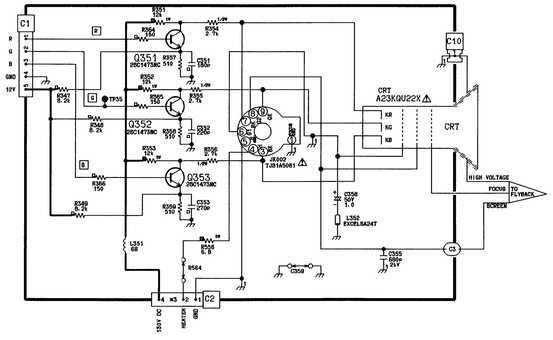


TNP111875AA
C–Board Schematic (CT–9R20T)



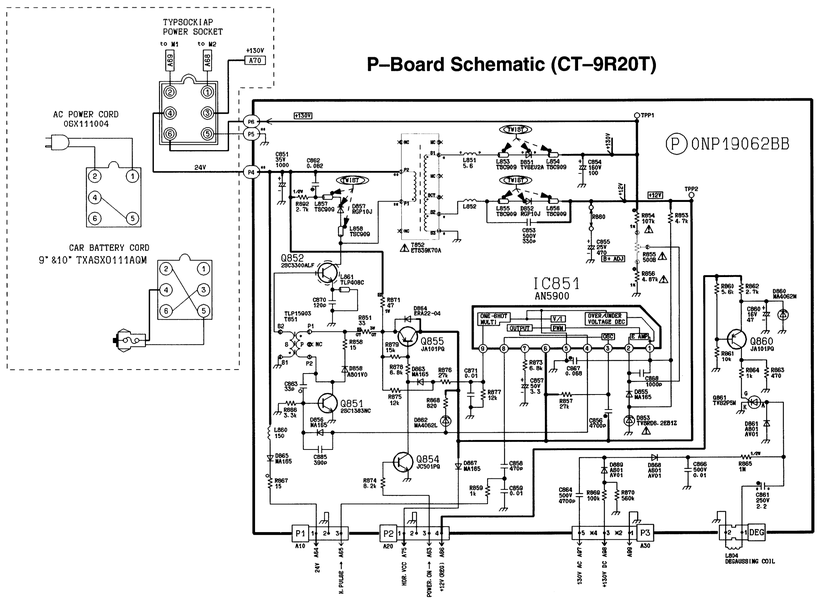
TNP111875ZA
C–Board Schematic (CT–9R10T; CT–9R10CT; & TP917T)



Voltage Chart – C–Board (All Models)

Transistors

Ref.	b	c	e
Q351	2.8	96.4	2.4
Q352	2.9	94.2	2.5
Q353	2.9	95.2	2.4



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